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MAN AND THE BIOSPHERE

MaB

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The Editor's Page

Hail And Farewell

With this issue PARKS bids a reluctant farewell to its readers around the world, a victim of declining funds that has affected so many.

A decade ago, in response to Recommendation 16 of the Second World Conference on National Parks, the first issue PARKS appeared as a USNPS/Parks Canada pilot project. Now, unless a last minute funding effort is made, it seems that PARKS and 1985 will pass into oblivion together.

For ten years PARKS has served as the primary medium for international exchange of professional information and issues dealing with protected areas, filling a need that becomes more critical with each passing year. In 1982 the World Congress on National Parks officially urged "IUCN to publish PARKS Magazine in three languages as a valuable tool in training and communication and specifically recommends that: ... IUCN, as the publisher of PARKS Magazine, endeavor to assume greater responsibility for publication and distribution of the journal..."

The delegates to the 16th IUCN General Assembly in November, 1984, "... Reaffirms the need for IUCN publication and sponsorship of PARKS International Journal, in three languages, for park and protected area site managers worldwide, and requests the Director General of IUCN specifically to: (a) establish a functional PARKS Editorial Advisory Committee and an honorary PARKS Board of Directors; (b) designate an individual or, as appropriate, a committee... to prepare within six months a suggested course of action for the Director General on alternative funding sources; (c) reinstate regular PARKS editions in French and Spanish as soon as financially feasible..."

None of these recommendations have been accomplished to the degree necessary. The editors have been working without salary since March, the time IUCN's formal commitment of production funds also expired. Because of the conservative use of previously allocated printing funds, we have been able to provide you with two additional issues of the journal—but no more.

The goal of PARKS has always been to provide strong, practical information and assistance to field and professional personnel worldwide. The letters of praise and encouragement we have received over the years attest to our success in this effort. We appreciate these many voices that have been raised on PARKS behalf, and again express our thanks to all of you for your support.

IUCN is now in the process of consolidating its publications under one manager, expecting economies of scale and improved service to its members as a result. PARKS will be considered during the consolidation, and there may yet be a future for the journal.

IUCN has played a major role with PARKS, actively working to further the concept and thrust of the journal, seeking funding from other sources, and assuming publishing responsibility. Although never included in the core IUCN budget, PARKS has been funded through the generosity of sponsors and cooperating organizations. At various times those sponsors have included:

American Conservation Assn., Australia (federal and state governments), Eastern National Park and Monument Assn., FAO, France (Ministere de l'Environement), IUCN, New Zealand, Organization of American States, Parks Canada, UNESCO, UNEP, USAID, US National Park Service, Wharton Trust, WWF-International and WWF-US. They all deserve our gratitude.

This is not the first time the journal has been in financial difficulty. In order to continue in 1981 we were forced to suspend publication of the French and Spanish versions. We had always hoped that funding would become available to resume these language editions—instead the English version will follow them into silence.

Bob Standish and I are the only two editors PARKS has had. We both deeply regret that this step has been forced upon us, but there seems to be no alternative but to accept what we hope will only be a hiatus in the publication of PARKS.

Our thanks and best wishes to you all.

Jean Packard

In This Issue

We turn our attention this quarter to the biosphere reserve project in UNESCO's Man and the Biosphere Program. We do so because biosphere reserves are being established in nearly all parts of the world. There are now 243 in 65 countries, and the number is growing rapidly. We do so because of the growing worldwide interest in biophere reserves as a uniquely modern concept in global conservation and a new approach for demonstrating the importance of protected areas to society. We do so because protected area planners, managers and policy makers need to know about the concept and its implications for conserving biological diversity, improving the standard of land management and enhancing the well-being of people. Finally, we do so because the biosphere reserve concept may provide a key for marshalling the financial resources, intellectual talent, and human energies required to reinvigorate the protected area movement in the years ahead.

In this issue we explore how the biosphere reserve concept is being adapted to meet the needs of countries differing widely in their natural environments, cultural traditions, socioeconomic conditions and institutional capabilities. In Canada, the Virgin Islands, Mexico, Panama, France, Rwanda, and the Soviet Union, biosphere reserve administrators and project leaders describe unique challenges and accomplishments in the unending process of building and maintaining the many functions of a biosphere reserve. For the case studies initiated several years ago, these efforts have met with obvious success; in others just getting underway, the success of today's initial efforts must await the verdict of tomorrow. However, all of the examples illustrate the promise and potential of biosphere reserves in providing the knowledge, skills and human values needed to develop and sustain harmonious relationships between human societies and the diverse ecosystems of the biosphere.

For additional information on UNESCO's Man and the Biosphere Program, its Biosphere Reserve Project, or a copy of the Biosphere Reserve Action Plan, write to:

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Biosphere Reserves: Demonstrating the Value of Conservation in Sustaining Society

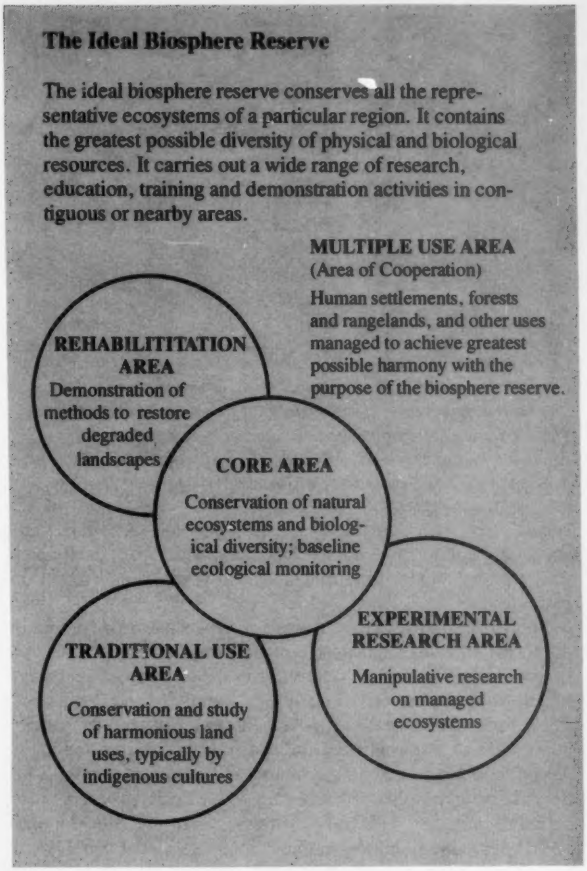
Since UNESCO designated the first biosphere reserves in 1976, the biosphere reserve concept has attracted increasing global attention. As one of ten categories of protected areas recognized by IUCN's Commission on National Parks and Protected Areas, the biosphere reserve has an established place in world conservation(1). In recent years, considerable effort has been given to clarifying the relationship between biosphere reserves and other types of protected areas, such as national parks (2, 3, 4). The number of conferences, workshops, popular articles and professional publications on biosphere reserves increases annually, and the development of the international network of biosphere reserves has become a cornerstone of UNESCO's Man and the Biosphere Program. While its unique niche in the protected area lexicon has yet to crystallize, it is clear that the biosphere reserve embodies a modern — some might say revolutionary — approach to the conservation and management of protected areas.

Central to the concept is the conservation of large units of landscape containing both natural ecosystems, in which man has little impact, and managed ecosystems, in which man substantially controls or influences the processes. A biosphere reserve thus may contain many different kinds of land uses and human activities. It is a "reserved" portion of the biosphere, with man as an integral component.

In the idealized model, the heart of the biosphere reserve is the **core area,** a primitive wilderness, strictly protected and maintained free of human disruption to conserve a representative example of the ecosystems of one of the world's major natural regions. It is a place where natural processes, including biological evolution, continue undisturbed, and where as much of the region's biological diversity as possible is included.

Surrounding the core are areas managed for agriculture, grazing, forest production, fisheries, intensive recreation, or other eco-

The Montseny Natural Park Biosphere Reserve in Spain specializes in environmental education. This class is studying the ecology and management of cork oak woodlands, now largely displaced by development. Photo: Servei de Parcs Naturals.


The Ideal Biosphere Reserve
The ideal biosphere reserve conserves all the representative ecosystems of a particular region. It contains the greatest possible diversity of physical and biological resources. It carries out a wide range of research, education, training and demonstration activities in contiguous or nearby areas.
MULTIPLE USE AREA
(Area of Cooperation)
Human settlements, forests and rangelands, and other uses managed to achieve greatest possible harmony with the purpose of the biosphere reserve.
REHABILITITATION AREA
Demonstration of methods to restore degraded landscapes
CORE AREA
Conservation of natural ecosystems and biological diversity; baseline ecological monitoring
TRADITIONAL USE AREA
Conservation and study of harmonious land uses, typically by indigenous cultures
EXPERIMENTAL RESEARCH AREA
Manipulative research on managed ecosystems

nomic uses of renewable resources. The emphasis here is on sustainable development of these natural resources in ways that minimize impacts on natural processes and genetic resources.

Biosphere reserves differ from traditional multiple use areas because of the importance of developing the areas along two complementary lines: as centers for generating and applying information to solve practical problems, and as centers for mobilizing human cooperation to this task. This particular dual emphasis within the framework of an international network is the key characteristic distinguishing biosphere reserves from other protected areas. The identity of the biosphere reserve and the power of its symbolism are rooted in the notion that protected areas, used for information and cooperation, can make major contributions toward solving the interrelated environmental, land use and socioeconomic problems facing particular localities, regions and the world; and, in so doing, help alleviate or prevent the human and ecological tragedies associated with these problems.

Biosphere reserves, then, are envisioned as the geographic hubs for conserving expansive landscapes containing the characteristic ecosystems of a particular biogeographic region, and for ecological monitoring, research, education, demonstration and training relating to the conservation and wise use of these ecosystems. In this context, the core areas are benchmarks of regional and global environmental quality. They are sites for long-term ecosystem monitoring and provide essential information for evaluating the effects of natural and man-caused changes in the environment. This information can furnish early warning of changes, such as those brought about by atmospheric pollution, which may have far-reaching economic consequences. The core areas are also in-

This fenced plot in Australia's Hattah-Kulkyne National Park Biosphere Reserve is part of a research program to reduce the effects of introduced rabbits, which are excluded from the regenerating area behind the fence. The area in the foreground is grazed. Photo: Australian National Parks Service.

exhaustible "libraries" of genetic material, an immense informational resource available for scientific study and future applications in developing agricultural crops, animal products, pest control agents, pharmaceuticals, forest products and other materials for human progress.

The areas surrounding the core generate information for managing ecosystems on a sustainable basis for wildlife management, as well as for human subsistence and commercial economic uses. **Experimental areas** provide sites for manipulative research to improve our understanding of the effects of natural and human influences, as well as research and demonstration projects to develop and communicate improved resource management methods suited to the capabilities of local people and available technical and financial resources. **Rehabilitation areas** accommodate research, demonstration and training to restore ecosystems to approximate the pre-disturbance conditions or to restore sustainable economic productivity in areas degraded by human uses or, less often, damaged by storms or other natural events. **Traditional use areas** (also referred to as stable cultural areas) provide for the study of subsistence activities and harmonious patterns of land use by indigenous people, and for the judicious modification or supplementation of these practices using methods which respect and build upon their cultural traditions. The core, along with the other information-generating areas, serves as the focus of the scientific and technical cooperation that are essential to the success of the biosphere reserve.

Biosphere reserves provide ideal sites for maintaining and studying traditional uses, as most contain areas long used in harmonious ways to sustain indigenous populations. Here, a Miskito Indian fashions a dugout canoe, a traditional means of transportation in Honduras' Rio Platano Biosphere Reserve. Photo: James Barborak.

Functional Network

The existence of a functional network vastly increases the ability of biosphere reserves to generate useful information on natural and managed ecosystems, and predict how they may respond to natural and human influences. This potential stems from the use of biosphere reserves for developing and testing research hypotheses, with emphasis on long-term comparative studies (5). The comparisons involve pristine sites and sites manipulated in carefully controlled ways within the same biosphere reserve, among ecologically similar biosphere reserves in different parts of the world, and among biosphere reserves in ecologically different regions.

At the local level, these comparisons provide the basis for developing land use and management strategies which sustain biological diversity and improve the well-being of local people, while maintaining traditional patterns of harmonious use. At the regional level, they support the adaptation and extension of these strategies to accommodate regional variation in ecological, social, economic and cultural conditions. At the interregional level, they improve our perspective for addressing problems affecting many geographic areas or the biosphere as a whole, such as atmospheric pollution, desertification, tropical deforestation, and the increasing isolation of protected areas as a result of changes in surrounding land uses.

While biosphere reserves furnish information at many levels, a broad base of support depends upon how successfully the knowledge and skills they develop are applied in implementing approaches to economic development which demonstrate the value of conservation. The cornerstone of this "biosphere reserve approach" is cooperation among administrators, local people, and the agencies and institutions responsible for land use and development. Cooperation on the technical level translates the results of biosphere reserve programs into patterns of land use which conserve biological diversity and natural processes within the context of sustainable regional development. Cooperation builds an atmosphere of trust and fosters commitment to conservation and improving the well-being of a region's people.

Through cooperation, the protection of the core and other biosphere reserve areas becomes more secure as local people receive tangible economic benefits, and improve the cost effectiveness and sustainability of development and educational programs. The geographic area in which the benefits of cooperation are being actively demonstrated forms an "area of cooperation" (sometimes called a buffer zone). This area varies according to the nature of ongoing cooperative activities. Although cooperating landowners and administrators of adjoining lands may be included within the biosphere reserve boundary, formal incorporation is secondary to the successful cooperative relationships upon which the development of a regional model for sustainable ecosystem conservation depends (6).

Biosphere reserves provide centers for developing sustainable economic uses through improved methods for managing ecosystems. Range management practices typify an important method of continuing assessments. Photo: US MAB.

Long term monitoring of natural and man-caused ecosystem changes in biosphere reserves provide benchmarks of global environmental quality. The continuing collection of ecological data is exemplified at this monitoring station at the H.J. Andrews Experimental Forest Biosphere Reserve in the US. Photo: Jerry F. Franklin, US Forest Service.

The various parts of a biosphere reserve share many common purposes with other categories of protected areas. In fact, biosphere reserves have been referred to as the "master integrator" of functions performed individually or severally by such areas (7). Their distinctiveness and particular value to society results from the importance of fostering scientific and educational uses and multifaceted cooperation: among scientists of different disciplines; between basic and applied research sites within the biosphere reserve; between protected area administrators and rural development agencies; among scientists, administrators, and local people; and, through the international network, between and among developed and developing countries.

In developing countries, biosphere reserves can enhance the security of significant natural ecosystems and protected areas through programs to improve the land management skills, health and economic well-being of local people, upon whose shoulders sustainable conservation ultimately depends. Biosphere reserves can also serve as centers for marshalling the financial resources of the international rural development sector which make integrated development projects possible, and the continuing interest and involvement of the international conservation and science sectors which help make them sustainable.

In developed countries, where many of the world's leading centers for ecological research have been designated biosphere reserves, the network fosters regional and international scientific cooperation on significant environmental problems, and provides a valuable framework for improving the predictive capabilities of modern ecology.

In some countries, biosphere reserves are playing an increasingly important role in ecosystem conservation. By linking complementary sites under different administrators to form a biosphere reserve named after the biogeographic region, it has been possible to create large protected areas and new symbolic focal points for institutional cooperation to conserve biological diversity. In other instances, biosphere reserves are promoting regional resource management approaches based on better cooperation between national parks and surrounding communities.

The case studies in this issue demonstrate a range of approaches and their practical benefits. Together, they illustrate a fundamental characteristic of the biosphere reserve approach: flexibility and

adaptability to meet the needs of different cultures, ecological regions and nations.

Action Plan

A milestone for biosphere reserves occurred in December 1984 when MAB's International Coordinating Council adopted a strategic "Action Plan for Biosphere Reserves." The plan was developed by the UNESCO MAB Secretariat based on the recommendations of the First International Congress on Biosphere Reserves, held in Minsk, Byelorussian S.S.R., in 1983. The plan clarifies the characteristics of biosphere reserves, and provides a framework for allocating the technical and financial resources of United Nations agencies and international conservation and scientific organizations in developing the biosphere reserve network and its functions. It also serves as a guide for the 105 National MAB Committees in planning and coordinating their own programs within the international network. The plan lists objectives for developing 9 specific functions, and recommends 35 actions for initiation between 1985 and 1989. Collectively, the actions represent a blueprint for dramatically increasing the contributions of biosphere reserves in conserving the planet's biological diversity, and in enhancing the role of protected areas in sustainable economic development in concert with the World Conservation Strategy.

Action Plan Objectives for Biosphere Reserves

1. International Network: to enhance the role of the international network of biosphere reserves in global ecosystem conservation.
2. Management: to improve and upgrade the management of existing and new biosphere reserves to correspond with their multi-purpose objectives.
3. In Situ Conservation: to promote the conservation of key species and ecosystems in biosphere reserves.
4. Research: to promote coordinated research projects on conservation science and ecology within biosphere reserves.
5. Monitoring: to develop monitoring activities in biosphere reserves in order to provide a basis for scientific research and management activities and contribute to the understanding of environmental change.
6. Regional Planning: to enhance the role of biosphere reserves in regional planning and development.
7. Local Participation: to promote local participation in the management of biosphere reserves.
8. Environmental Education and Training: to promote environmental education and training related to biosphere reserves and to use the full potential of the reserves for these purposes.
9. Information: to use fully the potential of the network to generate and spread knowledge about the conservation and management of the biosphere and to promote the biosphere reserve concept through information and demonstration.

Human domination of the biosphere is a fact of life. The human population, once sparse and localized in its influence, is now large, well dispersed, and planetary in impact. Protected areas, once shielded by their remoteness, now can be conserved only by human volition and well-conceived strategies. In many parts of the world, purposes established by laws and decrees do not square with the reality of "protected" resources being consumed to meet legitimate subsistence needs of local development, or affected adversely by man in a myriad of other ways. To stem the progressive erosion and loss of the planet's biological diversity, protected areas must become active participants in shaping their own destiny, rather than passive witnesses to the decline.

New models are needed. By providing a geographic focus for research, education and continuing cooperation, biosphere reserves can involve protected areas in the sustainable development of entire regions, and address major environmental and human problems. In this way, they can expand the basis for protection and increase political and financial support, particularly from the development sector. By providing a new "activist" symbolism, the biosphere reserve can ignite and maintain the enthusiasm and commitment needed to make the transition possible.

Literature Cited

(1) I.U.C.N., Commission on National Parks and Protected Areas. 1984 Categories, objectives, and criteria for protected areas. Pp. 47-55 *in* J. A. McNeely and K. R. Miller (eds.). *National Parks, Conservation, and Development: The Role of Protected Areas in Sustaining Society.* Smithsonian Institution Press, Washington, D.C. 825pp.

(2) I.U.C.N. 1979. The biosphere reserve and its relationship to other protected areas. UNESCO, Paris. 19pp.

(3) Halffter, Gonzalo. 1980. Biosphere reserves and national parks: complementary systems of natural protection. *Impact of Science on Society* 30(4):269-276

(4) MacFarland, Craig. 1984. Relating the biosphere reserve to other protected area management categories. Pp. 196-203 *in* UNESCO-UNEP. *Conservation, Science and Society.* UNESCO, Paris. 2 vols., 612pp plus annexes.

(5) diCastri, Francesco, and Malcolm Hadley. 1984. Comparative ecological research and representative natural areas. Pp. 301-310 *in* UNESCO-UNEP. *Conservation, Science, and Society.* UNESCO, Paris. 2 vols., 612pp plus annexes.

(6) Cowley, Michael and Bernie C. Lieff. 1984. Extending the biosphere reserve by involving local people. Pp. 548-552 *in* UNESCO-UNEP. *Conservation, Science, and Society.* UNESCO, Paris. 2 vols., 612pp plus annexes.

(7) Gregg, William P., Jr. 1984. Multiple-site biosphere reserves for better management of regional ecosystems. Pp. 12-19 in *Proceedings of the Workshop on Biosphere Reserves and Other Protected Areas for Sustainable Development of Small Caribbean Islands,* St. John, U.S. Virgin Islands, 10-12 May 1982. National Park Service, Southeast Regional Office, Atlanta, Georgia.

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Vladimir Sokolov

The System of Biosphere Reserves in the USSR

The biosphere reserve, introduced under the MAB programme in 1971, complements other national efforts at nature conservation. Historically, landowners set aside reserves for hunting purposes to maintain a continuous supply of game for their own consumption. The national park concept, begun in Yellowstone in 1872, diverged from this commodity-oriented form of conservation by proposing the protection of natural areas for the "welfare and joy of the people." Essentially, such areas were established for conservation purposes (preservation of rare plant or animal populations, unique or typical landscapes, historical sites), for recreational purposes or for scientific research and monitoring. Ideally, every country should possess a network of all these types of protected areas, and different countries have shown different approaches to this endeavor.

This international trend has also been followed in the Soviet Union. The first recorded conservation area was established in the 13th century as the Belovezskaya Puscha Reserve in the Yagello area. In the 14th century, bird colonies on islands in the Barents Sea were protected so that gyr falcons could be caught and sent for falconry for the Tsar. Similarly, large areas of woodlands and marshes were strictly protected in the 18th century for elk hunting. Other natural landscapes were protected by religious orders and monasteries such as the reserves near the Konds and Sosva rivers and in western Siberia.

In the period from 1850 to 1860, the steppes of the Ukraine were extensively ploughed and subsequently a movement began among scientists to conserve some remaining areas of virgin steppe land. For example, scientists consulted the landowner Faltz-Fein and consequently a number of sites were set aside, one of which became the Askania-Nova Reserve in 1889. At the same time, scientists such as Dokuchaev, Anuchin, Taliev, Borodin and Kozhevnikov developed theories on land use and soils and emphasized the importance of protected natural areas for scientific research, particularly on natural ecological processes. They indicated how man's impact on the environment could be observed, measured and ff tntually predicted, by using natural, unmodified areas as "background" or control sites.

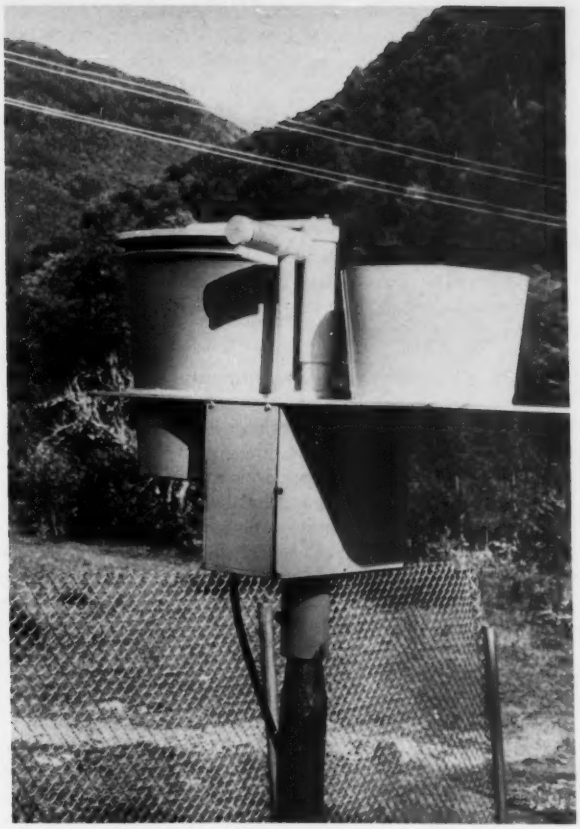
Numerous nature reserves were established in the 20th century, such as the Vaika Islands in 1906 (now the Vilsandiisky Reserve). Moritzsala near the Baltic Sea in 1910, the Ilmen Mountains in the Urals in 1911, and the Lagodekh ravine and unique relict pine forests in the Caucasus Mountains. A special mission undertaken by scientists in 1914-1916 resulted in the establishment of the Barghuzin Reserve in 1917. However, these efforts were sporadic and there were no state funds to ensure efficient protection and management. A more systematic approach to establishing nature reserves was adopted after the Soviet Revolution in 1917 on the basis of identifying regional biological features and azonal ecosystems.

Note should be made of the many reserves that have been established to protected dwindling populations of rare plants and animals. For example, several reserves in the Central Chernozem, the Caucasus and Zhiguli ranges protect relict plant and animal com' mnitti ts; the Voronzeh Reserve has helped restore the population of the European beaver *(Castor fiber),* of which there were only a few dożen remaining in the early 1920s and now is numerous enough to be exploited commercially; the Sayany, Kronotsky, Kondo-Sosvinsky, Barguzinsky, and other reserves in the taïga region have similarly restored stable populations. Better known is the success story of the European bison *(Bison bonasus)* whose restoration was begun in the Belovezhskaya Puscha and subsequently in the Prioksko-Terrasny and Caucasus reserves. The goral *(Nemorhaedus goral),* the rarest animal of the USSR, is protected in the Lazovsky and Sikhote-Alin reserves.

Setting up Biosphere Reserves in the USSR

The more recent systematic approach to establishing nature reserves in the USSR is similar to the selection process proposed for establishing an international network of biosphere reserves. Furthermore, the use of conservation areas for scientific research and monitoring is a priority in the USSR, which possesses a large range of ecosystem types for studying man's impact on natural areas. On the basis of the global system of classification prepared by Udvardy (3), a national effort was begun in 1976 in order to allow a systematic selection of biosphere reserves that would represent the major ecosystems of the USSR, including wetlands and lake ecosystems. At present, there are seven biosphere reserves in the USSR; eventually, twenty reserves will be established of which three (Baikal, Aral and Ladoga) will cover aquatic ecosystems. Following are brief descriptions of the seven existing biosphere reserves *(Editor's note:* in December, 1984, the MAB Bureau approved UNESCO designation of 10 additional biosphere reserves in the USSR, bringing the current total to 17). Further information in Sokolov (2):

The **Caucasus Biophere Reserve** has been selected to represent the Black Sea-Ghirkan province of broad-leaved mountainous forests under the USSR system of classification. With mountains over 3,000 m (9,843 ft) in altitude, this reserve contains in fact a range of vegetation types from broadleaved forests to fir forests and alpine meadows. The flora is very rich, with some 3,000 species, of which one-fifth are endemic to the Caucasus Mountains. The fauna



Many biosphere reserves are ideal sites for monitoring baseline changes in airborne pollutants, using sophisticated instrumentation such as this atmospheric sampling device in the Soviet Union's Caucasus Reserve. Photo: C. Wiersma.

includes 59 mammals, among which is the endemic wild goat *(Capra caucasica)*.

The **Berezinsky Biosphere Reserve** represents the north European province of coniferous and broadleaved forests and wetland areas, typical of the Russian plain. This reserve is situated along the upper course of the Berezina River, which is one of the few remaining refuges of the European beaver. Other noteworthy features include the populations of black stork *(Ciconia nigra)* and the attempts at breeding capercaillie *(Tetrao urogallus)*.

The **Prioksko-Terrasny Biosphere Reserve** is located in the same province as the Berezinsky, but borders on the broadleaved forest zone. Along with typical mixed forests on the slope of the high terraces of the Oka River, the reserve contains a whole range of plant communities, including relict steppe plants such as feather-grass. Capercaillie and elk *(Alces alces)* are present; common birds include the roller *(Coracius garrulus)*, hoopoe *(Upupa epops)* and woodpecker *(Picus viridis)*. The reserve has a European bison breeding station which has contributed greatly to the restoration of the bison populations.

The **Central Chernozem Biosphere Reserve** lies in the East-European steppe province. This reserve contains a number of plots of virgin grassland (200-5,000 ha/500-12,000 ac) among the ploughed areas. Studies are conducted on formation of the fertile thick chernozem soils, the relationship between woodland and grassland communities under moderate and deficient water regimes and the ecology of a number of plant and animal species.

The **Sikhote-Alin Biosphere Reserve** is situated in the Okhotsk province of the taïga zone, mainly on the eastern slope of the Sikhote-Alin range, with a small portion along the Sea of Japan. Due to differences in aspect and altitude, the vegetation cover is extremely diverse, with numerous relict and endemic species. Notable animals include the goral, a rare mountain antelope, and the Siberian tiger *(Panthera tigris)*.

The **Repetek Biosphere Reserve** represents the Turan desert province in the Kara Kum desert. The flora includes some highly specialized desert types adapted to grow on the mobile sands of barkhan ridges, and also on the saline clay depressions called "takyrs." Noteworthy species include the desert monitor *(Varanus griseus)*, goitred gazelle *(Gazella subgutturosa)*, caracal lynx *(Felis caracal)*, gerbils and jerboas. Research in the Repetek Reserve is being conducted on desertification and ecological aspects of rational management of arid lands.

The **Sary-Chelek Biosphere Reserve** is located in the Central-Asiatic mountain province in southwestern Tyan-Shan. The reserve includes nut-fruit forests, spruce forests and mountain grasslands. Of particular interest are animal species such as the white-clawed bear *(Ursos a. leuconyx)* and snow leopard *(Panthera unica)*.

Research and Monitoring in Soviet Biosphere Reserves

The tendency has been to establish biosphere reserves where reserves already exist, which presents both advantages and disadvantages. The advantage of a long-established research or monitoring site is fairly obvious, as these historical data are highly valuable in launching research and monitoring activities for the biosphere reserve in question. For example, most nature reserves in the USSR have established "natural records," standard information on meteorology, hydrology, the productivity of various plant communities, animal censuses, breeding and hibernating activities of certain species, outbreaks of disease, wildlife, etc., which has been gathered over the last 50 years. This information is fundamental for conducting new research projects to solve specific ecological problems. Systems analysis has proved particularly useful in studying the structure and dynamics of the ecosystems of the USSR biosphere reserves, based on the data collected at these sites.

Ecological monitoring, even in such a large country as the USSR, is even more useful when comparisons can be made with ecologically similar sites in other parts of the world. In this connection, the USA-USSR project on biosphere reserves, established under the bilateral agreement on "Cooperation in the Field of Environmental Protection," has proved particularly interesting and useful. Biosphere reserves in both countries were selected specifically for the purpose of comparative ecological studies. Two sets of "sister" reserves have been proposed so far: that of the Berezinsky Reserve with the Isle Royal National Park, and the Sikhote-Alin Reserve with Olympic National Park. Bilateral meetings on biosphere reserves have been held under this project in 1976 in Moscow and in 1980 in Miami. Several themes of cooperative research were identified, including research on natural successional changes and monitoring of certain atmospheric and aquatic pollutants. In 1982, a group of scientists from the USA visited various reserves in the USSR, including the Berezinsky, to compare methodologies and data on certain biotic and abiotic parameters measured in both countries (e.g., litter decomposition rates, ozone levels). Currently, daily measurements of dust content, sulphur dioxide, mercury, lead, cadmium, arsenic and carbohydrates are made as appropriate in the atmosphere, rainfall, soil and plants in the Berezinsky, Prioksko-Terrasny and Caucasus reserves, and on a periodic basis in the Sary-Chelek reserve. Atmospheric ozone and

A mounted guard patrols the Central Chernozem Biosphere Reserve in the east Europe steppe province. Photo: Jerry F. Franklin, US Forest Service.

SO_2 levels and DDT concentrations are also measured using high altitude apparatus.

Each of the biosphere reserves in the USSR also conducts research on the impacts of various forms of land use on the natural ecosystem. For example, the effect of agriculture and drainage on the wetlands and woodlands of Berezinsky, the impact of recreation at Prioksko-Terrasny, of stockraising on the sand deserts at Repetek, the effects of logging and fire on the ecosystems in the Sikhote-Alin and Caucasus reserves.

Two problems in selecting suitable sites to be nominated as biosphere reserves should be mentioned. One concerns the need to establish a core area which consists of an as unmodified as possible example of the ecosystem of the given biogeographical province, surrounded by a buffer zone with the same ecosystem type under various forms of land use. Such ideal situations do not always occur in reality, particularly when it is desirable to have a field station or scientific institution in close proximity. The solution to this problem often lies in setting up new research facilities and experimental plots around an already protected natural area.

The second problem, linked to the first, concerns the questions of coverage of all the biogeographical provinces identified in the USSR. Most of the nature reserves have been established in the European part of the nation and in accessible areas along the railway line to the east coast. Few reserves exist as yet in the vast territories of the northern Asiatic USSR. Biosphere reserves will have to be created in these areas, thus focussing interest in areas little studied by the scientific community up to the present, and complementing the national network of protected areas. This systematic, more integrated approach to protecting natural areas also helps to account for the needs of migratory animals and birds, and to identify and protect key wintering/summering areas, major flyways, etc. Special legislation, such as the "Law of Conservation and Use of Wildlife," adopted in the USSR in 1980, and international instruments concerning migratory species will further strengthen this particular role of biosphere reserves.

The importance of maintaining international links between ecologically similar biosphere reserves—or "sister" reserves—for monitoring and forecasting ecosystem change is well recognized. However, "sister" reserves can also play a crucial role in preserving viable populations of certain rare large animals which require vast areas of land. For example, some protected areas may be too small to hold the minimum required population size of 500 [Frankel and Soule, (1)], but two "sister" reserves together could perhaps adequately provide for this number, given that the two reserves collaborate very closely on an exchange breeding programme to maintain intraspecific genetic diversity and fitness, which implies very strong national or bilateral cooperation. Such links could be established through the international biosphere reserve network.

Biosphere Reserves and Environmental Education

Environmental education activities have high priority in the Soviet Union. All the nature reserves are endowed with visitor centers which familiarize the public with nature protection laws, the general objective of establishing a national network of reserves, and the objectives and characteristics of the specific reserve. There are often exhibits with naturalized specimens of the main plants and animals, nature trails and exclosures and open-air cages housing locally occurring animals. Publications and postcards are available for most biosphere reserves, as well as many films for television. In addition, a film on biosphere reserves in the USSR was specially prepared for the International Biosphere Reserve Congress (Minsk, 1983).

Mention should also be made of the environmental education posters made by the USSR MAB National Committee, following the example of the "Ecology in Action" poster series prepared by UNESCO-MAB in 1981. The Soviet posters are designed for school children aged 11 to 14. There are 15 posters in a set, covering topics such as the ecology of various ecosystems in the USSR (tundra, steppe, mixed forest), protecting and helping bird life, alternative logging practices, aquatic pollution, urban environments, soil erosion, threatened and endangered species in the USSR, etc.

No less than 60,400 copies have been made of this poster set, which are sent to schools throughout the USSR, accompanied by a teacher's manual to guide their use in the classroom. They can also be used for school groups visiting certain biosphere reserves, particularly as the ecosystems and the different forms of land use portrayed in the posters can then be studied in real life.

References

(1) Frankel, O. H. and M. E. Soule, 1981, *Conservation and Evolution*, Cambridge University Press, Cambridge, England.

(2) Sokolov, V. 1981. The Biosphere Reserve Concept in the USSR, *Ambio*, 10, (2-3), 97-101.

(3) Udvardy, M. D. F. 1975. *A Classification of the Biogeographical Provinces of the World*, IUCN Occasional Paper No. 18, IUCN, Gland, Switzerland.

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Bernie Lieff

Waterton Lakes Biosphere Reserve: Developing a Harmonious Relationship

Waterton-Glacier International Peace Park, the world's first, was decreed in 1932, encompassing Waterton Lakes National Park (525 km²-202 mi²) in southwest Alberta, administered by Parks Canada, and Glacier National Park (4,144 km²-1,600 mi²) in north-central Montana, administered by the U.S. National Park Service. Glacier became a biosphere reserve in 1976, and three years later, in keeping with the ties between the two parks, Waterton became Canada's second biosphere reserve.

The two parks under their international designation have a long history of cooperation in public safety, law enforcement, resource management, interpretive programming, staff exchanges, and fire management. The parks share the same visitor brochure, parks newspaper, and backcountry signage. Both parks have active biosphere reserve programs but each has placed emphasis on different functions to reflect its specific needs. The Glacier program emphasizes the research and monitoring function; Waterton's program concentrates on education and cooperation functions involving its neighbours who are ranch owners, scattered industry and provincial land management agencies.

Initially, the purpose of Waterton's program was to break down the "fences" which existed between the park and the adjacent landowners. The goal was to open up communication channels in both directions to allow the addressing of resource management issues of common concern.

Agriculture, natural gas extraction and timber harvesting are the main uses of land surrounding Waterton Lakes National Park. Photo: B. Russell.

How the "fences" were removed

The beginning was a public ceremony in 1979 to celebrate Waterton's designation as a biosphere reserve. A lot of the park's neighbours attended the ceremony and discovered the term "biosphere reserve." However, the concept was very new and its applications not easily understood in the context of a protected area in a developed country; also, the park had no organization, budget or perceived mandate to manage a biosphere reserve, so nothing happened for almost two years (Bull, 1983). Park staff then decided to host a workshop to explore the biosphere reserve concept and its local relevance. Invited were representatives of government agencies and universities, and local ranchers who were concerned about protecting the ranching community as well as the natural environment.

Key highlights of the workshop were the recognition that:

- there were obvious advantages for the park and its neighbours to work together solving common problems;
- the park was only a core area and nearby lands managed for consumptive purposes were needed to provide the basis for a functioning biosphere reserve;
- the international designation of Waterton would not place restrictions on landowners but would strengthen arguments for protection of their traditional land uses;
- the biosphere reserve program was developed by UNESCO and was not a federal government initiative to exercise control over private lands;
- research involving private lands, or other uses of them associated with the program, would only take place with the landowner's concurrence.

Thus the meeting laid the foundation for an expanded biosphere reserve, not through official designation of private lands, but through the cooperative efforts and mutual understanding of those involved.

At a second meeting, ranchers expressed the view that there would be more local support for the biosphere reserve concept if they headed up a committee to involve others and to develop a program dealing with issues of local interest. The Management Committee was formed, chaired by two ranchers representing the two nearby ranching communities. It also included three other ranchers, the Park Superintendent and the Chief Park Warden. Several local people indicated they were surprised at the new direction but also were somewhat suspicious. The Committee's initial goal was to promote an awareness of the biosphere reserve concept using local but simple applications.

Research plot on private ranchland in the zone of cooperation adjacent to Waterton Lakes National Park. Photo: B. Russell.

No Hidden Agenda

The Committee set out to involve its neighbours in identifying and addressing resource management issues of common concern. First it addressed terminology which local people found threatening. The main concern was with the term "buffer zone" which locally implies control by the government, and, therefore, is particularly repugnant to some landowners. The Management Committee replaced that term with "zone of cooperation" to signify park and local people working together. There also was a concern about the term "biosphere reserve" as "reserve" was not a term people wanted applied to their lands, again because it implies government control. Locally, reference is now made to the "Waterton Biosphere," a contradictory term which will likely be replaced by "Waterton Man and Biosphere Program."

The Committee's first initiative was to hold monthly public seminars involving experts addressing non-controversial issues. As an example, at several meetings spread of the exotic plant knapweed *(Centaurea* spp.) was discussed by control officers and park staff; ranchers were shown how the plant affects rangeland, how to identify it in various growth stages, what the park and province were doing to control it, and what steps they should take to prevent its establishment on their lands.

As local people became less suspicious of the program, the Committee addressed more controversial issues, an example being elk *(Cervus canadensis nelsonii)* management. Some ranchers near the park have a history of elk damage to their green crops and haystacks. They regard the animals as park elk, moving freely over fences between the park and agricultural lands, seeking park sanctuary during most of the year but leaving it when there is better feed outside on green cattle-grazed pastures. To deal with the issue, the park provided new fencing which decreased ranchers' fence maintenance costs, and the Biosphere Reserve Management Committee hosted several meetings to discuss provincial hunting regulations. At one meeting, provincial wildlife officials, park staff, and ranchers worked out a change to the provincial hunting regulations for the area which has resulted in an increased acceptable harvest and has decreased the elk depredation problem.

As another example, the Committee held a public meeting to advise people of research on grizzly bear *(Ursus arctos)* behaviour and a bear deterrent study. At each meeting, a member of the Committee explains the biosphere reserve program and current activities.

A Growing Program

The Management Committee, which meets at least monthly, has not yet addressed the issues of incorporation or elections for officers as it first wishes to establish a program which is strongly supported locally.

It has agreed to the following principles:

- Park management is ultimately the responsibility of the Park Superintendent just as others are responsible for the management of their lands;

- The core area is the national park and, therefore, its boundaries can be shown on paper, while the zone of cooperation is defined as encompassing lands of those local cooperators; it is a changeable area not to be defined in terms of specific boundaries;
- Committee members serve as volunteers although Parks Canada provides transportation where possible;
- Funding of the growing program through Canada/MAB and Parks Canada is to be augmented by fund-raising projects;
- Major new initiatives will be developed through the establishment of subcommittees.

To guide the work of the Committee, and better explain the purpose of the program, the following goal and objective were recently enunciated, as well as a set of five-year sub-objectives:

Waterton Biosphere Reserve Objective

To encourage the integration of use, development, and conservation of natural resources through programs of public information and education, and through environmental research and monitoring.

Waterton Biosphere Reserve Goal

To promote public awareness of resource management concerns facing residents of the Waterton Biosphere. Participate with area residents in developing projects to address local concerns. Encourage cooperative resource management practices between private landowners and governments by providing a forum for the exchange of information.

Having established a local base of public interest, the Committee became involved in the research and monitoring function which it felt would further increase local interest and involvement. It established a Technical Committee to screen research and monitoring proposals and to suggest how to address resource management issues of the area. Committee membership includes federal and provincial agencies which possess the required mandates. To set up the Technical Committee, the park superintendent and co-chairpersons approached local field officers to explain the biosphere reserve concept, then with their blessing, invited the agency to participate. It is noteworthy that there was not a single refusal at the federal and Alberta provincial levels. The idea of government and local people working together on issues of common concern has a strong appeal to senior administrators. (The Management Committee has so far been unsuccessful in involving the government of the neighbouring province of British Columbia because of a lack of a local population base there to support its involvement.)

The Technical Committee has eight members representing wildlife, forestry, agriculture, soil science and resource planning, and includes representation from the two national parks. Technical Committee members have been able to expand their own work to encompass the biosphere reserve. They have also fostered awareness of the reserve within scientific circles, resulting in a number of unsolicited research proposals.

Movement of elk between the park and ranchlands is being recorded along with cattle/elk interactions and their use of crops and pasturelands. An investigation of diseases in elk and cattle from the same area is underway with local hunters providing the tissue specimens. Also being investigated is the performance of various forage species at high altitude with the view that planting of improved yielding, high quality forage preferred more by cattle than elk may help offset the forage depredation by elk. Study plots for the vegetation trials are located on lands of cooperating ranchers. Field days are planned to acquaint ranchers with the results of these trials as they progress.

Waterton-Glacier International Peace Park. The townsite of Waterton Lakes is located on an alluvial fan in upper Waterton Lake. Glacier Park in the United States can be seen in the background. Photo: Parks Canada.

Future Thrusts

In order to get the MAB concept into the classroom, the Management Committee has formed an education sub-committee. With membership from the teaching profession, this group is developing an initial program for a particular age group.

The Committee has begun to keep more in touch with federal, provincial and local politicians. One result has been an agreement by Alberta to construct a highway vehicle pull-out with a biosphere interpretive message at a location overlooking the zone of cooperation.

Discussions have been held to explore the idea of joining the biosphere reserves of Waterton and Glacier with the Coram Experimental Forest in Montana. The resulting expanded area would be known as the Rocky Mountain International Biosphere Reserve. It has been decided, however, first to explore the usefulness of this idea in practice.

References

Bull, G. A. 1983. An Overview of the Situation with Respect to Waterton Lakes National Park *in* R. C. Scace and C. J. Martinka (ed) *Towards the Biosphere Reserve: Exploring Relationships Between Parks and Adjacent Lands,* Kalispell, Montana; United States Department of the Interior, publishers, 22-35.

Cowley, M. and B. C. Lieff 1984. Extending the Biosphere Reserve Through Involving Local Landholders and Land Management Agencies — A Case History, Waterton Biosphere Reserve *in* J. A. McNeely and D. Navid (ed) *Conservation, Science, and Society: The Contributions of Biosphere Reserves to Human Welfare,* Minsk, Russia; UNESCO, 503-507.

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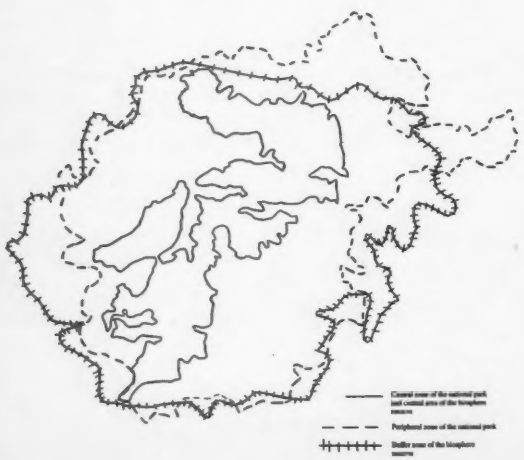
Gérard Collin

The Cévennes Biosphere Reserve: Integrating Traditional Uses and Ecosystem Conservation

The Cévennes National Park, which constitutes the larger part of the Biosphere Reserve, is located in the southern part of the French central mountains. The park's well developed hydrological Sea and to the Atlantic Ocean. The nearest large towns, Nimes and Montpellier, are about 120 km (75 miles) from the center of the park. The central zone encompasses the national park itself, which is the area regulated according to French law. This zone spreads across two political "departements" (Lozere and Gard) in the Languedoc Roussillon region. The peripheral zone (the area where the national park can only recommend on environmental matters) extends into Ardeche "departement" in the Rhône-Alpes region.

The geologically diverse national park includes a granitic massif at the north, a schist zone in the centre, a composite mountain of schist and granite at the south, and a limestone plateau in the west. Mont Lozere, the northern granitic massif is 40 km (25 miles) long and 15 km (9 miles) wide; its highest point is 1,700 meters (5,578 feet). The central schist zone is slashed by valleys opening toward the Mediterranean Basin. Aigoual, the composite mountain at the south, is a high zone, cut by an important hydrographic network. Sedimentary plateaus of Causse de Sauveterre, Causse Mejean and Causse Noir, in the west, are rolling regions bounded by deep canyons.



The geology, geographic location and great range of elevations results in many kinds of vegetation, including sub-mediterranean and mediterranean forest, atlantic forest, middle european mountain forest, various shrubby and grassy moors, and rocky vegetation. In general, it is a sub-mediterranean flora; among the 1,800 species present, there are many orchids and remarkable arborescent species.

The fauna is also distinguished more for its variety than its rare species. Birds of prey and predators in general (e.g. fox, marten) are well represented even when herbivores are relatively scarce. The Cévennes contains 50 species of mammals, 150 species of birds, 30 species of reptiles and batrachians, 20 species of fishes. The inventory of insect and invertebrates is not yet completed. Rare or threatened species include the golden eagle *(Aquila chrysaetos)*, peregrine falcon *(Falco peregrinus)*, and eagle owl *(Bubo bubo)*. The park is attempting to reintroduce some species, including griffon, vulture, beaver, grouse and black grouse.

The territory of the Cévennes shows numerous signs of human occupation dating back many centuries. Anthropological alterations have resulted in the replacement of forests by crops and pasture lands; more recently, with the decline of agrarian systems, moors and young forests have appeared. Fire, deforestation, pasturage, and opening of paths are the principal causes of environmental alteration, although some wet places (springs and peat bogs) have been little altered by man. The numerous hamlets are generally well integrated into this environment. Traditional rural architecture, dating back to the 17th century, is based mainly on local geological materials (schist, granite, limestone) which are still the basis of today's buildings. Some of these are closely related to the environment and economy of Cévennes, such as the small buildings (cledes) used to dry chestnuts and the "magnaneries" where silkworms are raised.

The importance of the Cévennes is not due to its uncommon flora or fauna, but in the character of its diverse landscapes where the natural and cultural heritages are tenuously mixed. On Mont Lozere the actual landscape is characterized by granitic chaos whose rocks, sometimes retouched, make up the walls of the existing buildings. The Causses were the meeting place of two megalithic civilizations of western Europe—one came from the British islands and the other from the eastern Mediterranean. The

Farmer restoring a thatched roof on one of the buildings within the park boundaries.

Causses landscape is short grass where exposed rock predominates. It has not always been so—the original forest was destroyed during Roman times in order to furnish firewood and resin for the great Roman Empire centres of pottery (Banassac, La Graufesenque). This deforestation contributed to the development of an architecture of superimposed vaults holding up a heavy roof of limestone tiles ("lauzes" in the provincial dialect).

The Schistose Cévennes region is a difficult place for human settlement because of its great slopes. For centuries men have climbed these steep slopes, carrying on their backs the earth that each Mediterranean storm washed down into the valleys. By valour and patience they have built terraces and hamlets into the sides of the Cévennes mountains.

The development of Cévennes civilization has been related to two main trees, the chestnut and the mulberry. The death of most of these trees due to disease at the end of the 19th century was devastating. The forested massif an Aigoual was almost totally destroyed between the 17th and 19th centuries, leading to erosion and floods. A gigantic afforestation program was undertaken, and today the forest covers almost all the mountain.

The long and extraordinary interplay between nature and man led to the creation of Cévennes National Park in 1970 under the 1960 national parks legislation. Like other French national parks, Cévennes has a central zone of 90,000 ha (222,390 acres) where the park officials have important statutory authority (supervision of hunting, building licenses, traffic), and a peripheral zone of 238,000 ha (588,098 acres) which is not under direct management of the park. In the latter area, park officials can only advise and try to influence the communities within the zone to conserve the natural features. Therefore the national park programs are carried out in the central zone.

There are some 600 people who live within this central zone.

A good example of the granite architecture found throughout the Cévennes area. Park administration pays the difference in cost between traditional building such as this and more modern structures, which might be less expensive.

This rocky landscape is typical of Causse Mejan sedimentary plateau in the western portion of the park.

For the first time in France a protected area is confronted with the problems of a variety of human uses of the environment, and with the challenge of finding the difficult and precarious balance between these human activities, and preservation of nature. Since 1970 management policies have been dedicated to meeting these challenges. In the field of architecture, the park administration asks the farmers to respect the traditional architecture (colours, size, materials) and pays the difference between the cost of a contemporary construction and a traditional one. In this manner the Cévennes architecture is maintained in harmony with the landscape without creating financial problems for the farmers. In matters of agriculture, environmental plans help the farmers improve their profits while avoiding damage to the environment. The park has bought pure-bred Aubrac cows (an endangered local species well adapted to the mountains) in order to lend them to farmers to breed with their Charolais species. Farmers may also work directly for the park under special contract; during the times they do not have too much work in the fields they cooperate in the maintenance of the park by clearing old trails for pedestrian tourists, cleaning undergrowth to prevent summer fires, or restoring common buildings (fountains, mills, ovens) in the villages.

Park authorities also organize cultural activities for permanent inhabitants, such as concerts and other entertainment, because it is an important part of the quality of life in a region where there is no theater, no cinema and poor television reception. The eco-museum of Mont Lozere, with the help and participation of associations and municipalities, is establishing a museographic system for the discovery and preservation of the local heritage occurring in this part of the Biosphere Reserve.

Biology provides a foundation for park management, but usually in concert with other sciences or technologies. Some of the specific actions taken to improve the biological value of Cévennes include reintroduction of some disappeared or endangered species, reforestation and forest management.

But the large part of the work is dedicated to reconciling normal human life with understanding of and respect for the environment. The similarity of Cévennes National Park and the MAB programme of biosphere reserves has led us to join the network. It appears that the Park authorities can go beyond their boundaries and deal more effectively with a number of problems with this new structure. For example, the boundaries of Cévennes National Park were established on administrative and political bases which, of course, are not in agreement with biological limits. The biosphere reserve is delimited according to the vegetation formations, and the scientific purpose is better defined in the biosphere reserve than in the national park. Biosphere reserves in general have two kinds of zones with two degrees of preservation, just as in the Cévennes. The central zone of the national park and the central area of the biosphere reserve are the same in Cévennes, but the park's peripheral zone and the biosphere reserve's buffer zone differ to some extent from the map. The biosphere reserve includes, for instance, the Tarn River canyon where reintroduced vultures are breeding.

(*Editor's note:* In the diagram of an idealized biosphere reserve on page 3, the referenced central zone of the Cévennes National Park and the central area of the Cévennes Biosphere Reserve would include the core, experimental, rehabilitation and traditional use areas. The buffer zone, as used in the Cévennes Biosphere Reserve, correspond to the area of cooperation in the figure.)

The work as a biosphere reserve is just starting. We have not yet prepared a management plan related to the international action plan for biosphere reserves. For the central area of the biosphere reserve we have to carry on with the national park policy. For the buffer zone we have to reinforce the policy in the peripheral zone and begin it in the newly added areas. The new French laws on regionalization give great powers to municipalities in environmental matters but without real means of implementation. Using the biosphere reserve framework, we should be able to develop a suitable policy for the environment outside of the central zone of the national park. We believe the special characteristics of the Cévennes Biosphere Reserve correspond well to the concept of biosphere reserves and provide great potential for its further development. We are also convinced that, through close relationships developed with the international network of biosphere reserves, we can make progress in the difficult balance between preservation and development.

Gérard Collin, chief of the Human Sciences Unit of Cévennes National Park, is responsible for the biosphere reserve program.

Photographs courtesy of Cévennes National Park.

Gonzalo Halffter

Biosphere Reserves: Conservation of Nature for Man

Since the establishment of the first national park more than a hundred years ago, a general consensus has existed concerning the need for a system of areas to conserve representative samples of different ecosystems to avoid the extinction of the largest possible number of animal and plant species. However, only in a few cases have we analysed how these areas should be established and how they can co-exist with the needs of increasing human populations.

At the present time the great challenge of world conservation policy is to address the apparent dichotomy between protected areas and regional development by developing new strategies having solid ecological, social and economic foundations.

In order to direct the conservation of natural resources along new lines, it must be understood that a number of alternatives exist. Many efforts have been made in different countries and in different historical times. Those which have succeeded are the ones that responded to the socio-cultural imperatives of each era and country.

I will briefly analyse the socio-cultural implications of the two most important solutions, which in a rather arbitrary way I have called "parks" and "biosphere reserves," the latter applying to those areas which follow or concide with MAB's supported plan.

In generalizing about parks and reserves I am aware of the enormous differences which distinct social, historical, economic and political structures impose upon the conservation of natural resources. However, this does not affect the validity of attempts to forge a global policy, providing we never forget that it is neither applicable to all examples nor the universal solution for every country.

Parks

Modern parks increasingly provide recreation areas for a largely urban population. Tourism, in its various forms, is widely accepted and very important, but other types of human activity are normally excluded.

Another purpose emphasizes protection of flora and fauna, but usually without consideration of the needs of the local human population. This type of park still has a useful function, especially in industrialized or developing countries with a rapidly growing urban population. However, in countries where biotic resource exploitation and unsolved land use problems exist, it is necessary to establish other types of protected areas.

The park solution requires several conditions in order to be feasible: (a) a country with relatively less extensive land modifications and large enough to be able to exclude one or more extensive areas from economic production; (b) little or no demographic pressure to settle these areas; (c) citizen respect for laws and regulations which protect nature; (d) a national policy which does not seek to enlarge the areas dedicated to agriculture and livestock at the expense of still undisturbed territories; and (e) an adequate general administrative structure, especially for parks.

At the present time these conditions are being achieved in very few countries. In the rest of the world, even where successful parks exist, the future presents a series of problems and questions. The areas may not be large enough to protect germplasm efficiently without interference from tourism and urbanization, or contamination from by-products of agriculture. Or, as is often the case in intertropical developing countries, encroachment from expanding human populations makes the "park" solution difficult at the moment and very uncertain for the near future. By the intertropical zone, I refer to an area containing four-fifths of the world's diversity in plant and animal species.

What are the basic difficulties in establishing a "parks" system in intertropical developing countries?

Land Conversion: The most important is an expanding rural population dependent solely upon an economically marginal agriculture. This action differs from traditional farming which, together with hunting and forest harvesting, can provide a living. The latter uses, which usually are in harmony with the environment, embody a wealth of knowledge transmitted from father to son—knowledge which is fast disappearing as a result of the impact of the consumer society. These indigenous land use systems are being replaced by agricultural and livestock operations requiring vast areas of natural vegetation which are rarely managed to allow the necessary time for forest recuperation. The effects of this expansion are increased by external economic pressures. Cattle raising is an excellent business, although of very little social benefit. In many Central American countries, deforestation for a meager agriculture is often followed by intensive cattle breeding which, because it tends to be widely practiced in unsuitable places, only accelerated degradation of the environment.

The lack of an adequate germplasm conservation policy: This lack of adequate policy should not be confused with the absence of good laws. In many cases the laws exist, but for many reasons they do not fully achieve the goals for which they were promulgated. The most often alleged cause for failure is the lack of funds. I believe that a far more important problem is the lack of staff with adequate scientific and resource management preparation as well as inaction caused by lack of goals and clear objectives on the part of the administrators.

Lack of continuity: The third great threat is the lack of continuity in policy and support for park conservation in the intertropical region, as in many countries outside it.

In many countries, the practical and conceptual limitations of

the traditional park are becoming apparent (10, 11, 12, 13) because many who are responsible for conservation policies are not aware of the distinct alternatives which have been developing.

One of the MAB's greatest contributions has been to provide a new approach for demonstrating the value of protected areas to society—namely, the "biosphere reserve" which, besides being an area for conserving representative ecosystems and germplasm, is also a research and training center for scientists studying certain productive activities, especially those benefitting local populations.

Biosphere Reserves

Not only the reserves in MAB's international network are included under the term "biosphere reserve," but also those biological or ecological reserves which are not presently integrated into the program, but follow similar management guidelines.

In several countries having important biosphere reserve networks, the reserves are pre-existing parks included in the new system or new areas created within the administrative and conceptual guidelines of parks. In these countries, parks and biosphere reserves are very similar and the responsible administrative units are usually the same. In other cases, the park, maintaining its own structure, purposes and administration, is incorporated into a biosphere reserve, which enlarges its area of influence and helps protect it from peripheral pressures. Finally, in other countries, the biosphere reserves constitute a separate system, complementary to, but administratively independent from, the parks.

In many documents, and in practice, the importance of research, the development of human resources and international cooperation have been emphasized. Not so general, but equally important, is the integration with the social system, analysed in what I call the "Mexican modality" of the biosphere reserve concept.

Mexico's Mapimi Biosphere Reserve is the home of the endangered desert tortoise (Gopherus flavomarginatus), once widely hunted by the "campesinos" for its meat. These hunting practices have sharply diminished since government-supported scientific programs have improved the inhabitants' subsistence, and the tortoise has become a symbol of local pride and protection. Photo: World Wildlife Fund.

The Mexican Modality

Efforts to develop the "Mexican modality" were begun in 1975 in La Michilía and Mapimí reserves in the State of Durango in north central Mexico. Our approach incorporates guidelines which, although included in UNESCO's general concept of biosphere reserves, are priorities in the Durango reserves. These are:

(A) To involve local population and institutions in the common task of germplasm conservation; (B) to address regional socio-economic problems through research and development work at the reserve; (C) to give the reserves administrative independence, through research institutions responsible to the higher authorities of the country; and (D) to consider the reserves (and also the parks) as a part of a global conservation strategy.

In a short period of time practical and important developments (8, 9, 10, 11, 15) as well as an international influence have occurred (7, 14).

For developing countries it is becoming increasingly unacceptable to set aside large tracts of land as parks while pressing human needs and requirements for improving economic productivity go unfulfilled. On the other hand, it is clearly suicidal for a park-reserve system in a developing country to neglect socio-economic necessities, even if the adopted legal measures seem adequate at present.

The "Mexican modality" makes the World Conservation Strategy its own: conservation is not only protection. It encompasses the latter, but also contains the maintenance, continuous utilization, restoration and enhancement of the environment. (1)

There is a double objective in the reserves already created in Mexico, and in those being established—the incorporation of the needs and interests of local peoples, and the development of projects for their benefit.

The first objective is to help achieve a better standard of living for poor field workers who have existed marginally for centuries. This can be accomplished through the research and demonstration activities in the biosphere reserves. A major focus is on analysis of traditional land uses and the design of experiments to assess possibilities for developing a variety of culturally acceptable ways to use biological resources for human welfare without causing ecological deterioration or germplasm loss.

The second objective is to get local people involved and help them solve their basic problems as a means to assure the long-term security and viability of the reserves. In areas with strong demographic pressure, there are no regulations which, by themselves, can prevent the penetration of human populations into a protected area and the deterioration of destruction of its flora and fauna. The only solution for the hungry peasant is to help him produce what he needs without his having to destroy nature's legacy to everyone.

Fortunately, examples exist of reserves which are contributing to the development of skills, technology and necessary policies for a rational management of the flora and fauna, soil and water.

In the Mapimí Biosphere Reserve area, the harvesting of candelilla wax *(Euphorbia antisyphilitica)* and extensive cattle raising are the only forms of subsistence. The Mexican Institute of Ecology, which is responsible for the reserve, has dedicated a great deal of research and experimental development to range management here and in other arid regions, while simultaneously carrying out studies to support conservation of flora and fauna. This kind of policy fosters cooperation and consensus in the region: the same biosphere reserve which conserves and studies flora and fauna also

With government support, science has improved the campesinos' subsistence by introducing improved animal husbandry, new methods of range enhancement and new economic activity, such as the beekeeping shown here. Environmental education programs tailored to the area have developed a trust between the local residents and the scientific community. Photo: Institute of Ecology, Mexico.

seeks solutions to local and regional problems. All these joint actions evolve in and around the reserve, providing the basis for obtaining continuing support from local people.

The third objective of the "Mexican modality" is to have each reserve administered by a research institution. Without question, the reserves should belong to a national system, but this does not imply that a national administration should be directly responsible for planning and implementation of research, education and training programs, or germplasm care. In many countries, administration by a scientific institution improves the stability on the reserve, as scientific institutions usually enjoy a greater continuity and independence from hasty administrative decisions than other potential administrators.

An important aspect of the "Mexican modality" is the dissemination of information about what a biosphere reserve is and the purposes it serves. Directed toward the region's inhabitants, our publicity programs explain that germplasm conservation, basic studies, cooperative regional research projects, research with immediate local application, and other reserve activities are interrelated and form part of the same project. This information is provided in a form easily comprehensible to the different groups of local people. According to Francis (6), "The most effective 'educational' measure that could be taken would be to develop at least one fully functioning biosphere reserve."

Biosphere Reserves and Conservation of Economically Valuable Germplasm

Setting aside the successful "Mexican modality" for biosphere reserves, I would like to turn to the important role of biosphere reserves in conserving economically valuable germplasm in both natural and traditional use systems.

In concert with the recognized benefits of global expansion of mechanized agriculture and improved and higher yielding varieties, there has been a progressive — some would say catastrophic — erosion of the basis for these benefits due to the extinction of races and local or primitive varieties of cultivated plants and domestic animals. This genetic material is irreplaceable as the raw material for incorporation of resistance to diseases into the few crop varieties of practically universal use, or to develop new nutritional characteristics, or even as an answer to new market demands, improved storage characteristics, resistance to handling and to different environmental conditions, etc. This germplasm, whether wild or forming part of a traditional agriculture system, is threatened by habitat changes, displacement of indigenous cultural traditions and land uses and over-exploitation. For example, land conversions for livestock could easily have caused the destruction of the only known populations of the native corn (*Zea mexicana*) had this valuable economic plant not been discovered in time (17).

Under the UNESCO policy on the conservation of natural and cultural heritage, such economically important genetic material should be considered at least as valuable as large mammals about which, with reason, conservationists are worried.

Because of the flexibility of their structure and management, biosphere reserves can be of fundamental importance in fostering the vitally needed cooperation between agencies and institutions responsible for protection and those in charge of genetic crop improvement. Prescott-Allen (17) discusses some of the problems such cooperation could help resolve:

"So even if an adequate range of the variation of a wild relative is being protected in a reserve, the user of genetic resources may not know about it (because of the lack of species lists and the absence of more detailed information), may not have access to the resource (because of permit restrictions), or may be hampered by the lack of facilities for research or standby storage of any material collected."

While important, germplasm banks are not themselves sufficient for the conservation of genetic material. "Germplasm of vegetatively propagated crops is difficult to maintain and usually must be grown continuously or replanted frequently; gene banks housing such germplasm are particularly susceptible to natural disasters and political change." [Plucknett *et al.*, (16)] Because of their empha-

sis on incorporating traditional land use systems in which such crops are cultivated, biosphere reserves can help conserve this germplasm.

There is one very exciting function of biosphere reserves seldom developed outside of Europe — the conservation of a set of balanced ecosystems, which result from a long interaction between man and nature. Dubos (5) and di Castri (4) have described how human acts can be creative in an ecological environment. Fortunately, in several European countries measures are being adopted for conservation of the natural-cultural heritage threatened by the homogenizing action of mechanization and market agriculture and the effects of massive tourism.

A Synthesis for the Action

A true biosphere reserve ought to be more than a conservation area. Without losing this character, its action and influence should be extended regionally and so contribute to more rational use of biotic resources. In that way the reserve becomes a pilot area, in which research, conservation, experimental development, and demonstration of improved use and management practices are brought together, thereby helping to resolve the conservation-development dichotomy.

What really happens in the modern technological world is that the social system, in determining its objectives and priorities, also establishes priorities for the natural system and its use (3).

The problem does not affect only developing countries; it also exists in industrialized nations and they also are developing solutions. Begue (2) points out that in Cévennes National Park (a true biosphere reserve) the main objective is the conservation of the deeply interwoven natural and cultural heritages. The radical separation of the social and natural world is a by-product of our industrial-commercial culture. Only a dynamic and holistic approach can break the natural world's dependence on social imperatives in order to integrate the principal policies of both systems into a single one.

The biosphere reserves must be laboratories where examples of this holistic approach are developed, and the values of the approach are demonstrated. They can lead the way to overcoming limited concepts of protected areas, still unknown in their social surroundings and country. Most importantly, they can increase support for the essential role of these areas in sustainable economic development in concert with conservation of the natural heritage.

References

(1) Allen, R. 1980. La Estrategia Mundial para la conservación: en qué consiste y qué significa para los parques. *Parques,* 5(2) 1-5.

(2) Begue, R. 1983. Participation des populations locales a la prise de decision d'amenagement dans les Cévennes. 1st International Biosphere Reserve Congress. MAB. Minsk, Byelorrusia.

(3) Bifani, P. 1982. La interrelación medio ambiente-desarrollo desde el punto de vista económico. *Opiniones,* Fasciculo No. 4, Politica y Planificación Ambiental, CIFCA, Madrid.

(4) di Castri, F. 1981. La ecología moderna: génesis de una ciencia del hombre y de la naturaleza. *Correo de la UNESCO,* 34:6-11 (April, 1981).

(5) Dubos, R. 1976. Symbiosis between the earth and humankind. *Science,* 193: 459-462.

(6) Francis, G. 1983. Environmental education and training in biosphere reserves: some Canadian experience. 1st International Biosphere Reserve Conference. MAB. Minsk, Byelorussia.

(7) Gilbert, V. C. 1983. Cooperative regional demonstration projects: environmental education in practice. 1st International Biosphere Reserve Congress. MAB. Minsk, Byelorussia.

(8) Halffter, G. 1978. Las reservas de la biosfera en el Estado de Durango: una nueva política de conservación y estudio de los recursos bióticos. *In* G. Halffter (Ed.). Reservas de la Biosfera en el Estado de Durango. Publ. Instituto de Ecologia, 4: 13-45.

(9) Halffter, G. 1981. The Mapimí Biosphere Reserve: local participation in conservation and development. *Ambio,* 10(2-3): 93-96.

(10) Halffter, G. 1984. Conservation, development and local participation, *In* di Castri, F., F.W.G. Baker and M. Hadley (Eds.). Ecology in Practice. Tycooly International Publishing Limited, Dublin. Vol. 1:428-436.

(11) Halffter, G., P. Reyes-Castillo, M. E. Maury, S. Gallina and E. Ezcurra. 1980. La conservación del germoplasma: soluciones en México. *Folia Entomológica Mexicana,* 46: 29-64.

(12) Lusigi, W. and Jane Robertson. 1981. La conservación de la naturaleza. *Correo de la UNESCO,* 34: 28:29 and 34 (April 1981).

(13) Maldague, M. 1981. Le concept de reserve de la biosphere, son implantation et sa vocation en tant qu'instrument pour le developpement integre. *In* di Castri, F., F. W. G. Baker and M. Hadley (Eds.). Ecology in Practice. Tycooly International Publishing, Dublin. Vol. 1: 376-401.

(14) Nietschmann, B. 1983. Biosphere reserves and traditional societies. 1st International Biosphere Reserve Congress. MAB. Minsk, Byelorussia.

(15) Ochoa-Solano, A., G. Dávila O., S. Razo R., A. Garcia V., S. Rivas P., J. U. Cabrera-Pech, R. Arana E., L. Villalpando D., J. Galíndez, N. Ruiz Ordaz and J. E. Grajeda. 1978. Desarrollo Experimental de Agroindustrias en el Estado de Durango. *In* G. Halffter (Ed.). Reservas de la Biosfera en el Estado de Durango. Publ. Instituto de Ecologia. 4: 109-132.

(16) Plucknett, D. L., N. J. H. Smith, J. T. Williams and N. Murthi Anishetty. 1983. Crop germplasm conservation in developing countries. *Science,* 220: 163-169.

(17) Prescott-Allen, R. and C. 1981. Protected areas and the conservation of genetic resources. PA DATA, Victoria, B. C., Canada.

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Bill Weber

Le Parc National des Volcans Biosphere Reserve: Cooperation Between Conservation and Development

Traditionally, conservation and development have been viewed as mutually exclusive processes. In recent years, however, the models which separately guide these two fields have undergone significant changes, with a growing recognition of convergent interests between the two. Out of this recognition a more unified theory of conservation and development has begun to emerge.

In the mountainous African nation of Rwanda, a demonstration of this complementarity has been underway for several years, with its focus on the Parc National des Volcans Biosphere Reserve.

The Virunga Environment

The Virunga volcanoes dominate the northern Rwandan landscape. Rising as high as 4,507 meters (14,787 feet), five principal cones and scores of lesser calderas stretch along a 65 km (40 mile) front to form the international boundary between Rwanda, Zaire and Uganda. Of the total 400 sq km (154 sq mi) conservation area, approximately 150 sq km (58 sq mi) are protected in Rwanda's Parc National des Volcans (PNV).

The vegetation of the Virungas is representative of the overall afromontane biogeographic region. At the lower boundary of the PNV (2,500 m—8,203 ft), relic patches of *Prunus* forest are found within a broad zone of bamboo *(Arundinaria alpina)*. Slightly higher, more open *Hagenia-Hypericum* woodlands predominate up to 3,200 m (10,535 ft) before giving way to a sub-alpine flora characterized by distinctive giant *Senecio* and *Lobelia*. On the highest and sometimes snow-covered summits, only patches of mosses and lichens remain.

While tourism has generated significant foreign revenue, it has also permitted Rwandans to view their own wildlife resources —often for the first time.

The lower vegetation zones of the Virungas provide essential habitat for a variety of montane wildlife. In addition to more than 100 species of birds, the forest is home to elephants, buffalo, bushbuck, duiker, giant forest hog, leopard, hyena and hyrax. Among the half-dozen primates known in the region, the rare golden monkey *(Cercopithecus mitis kandti)* is especially noteworthy. But the undisputed king of this particular jungle is the mountain gorilla *(Gorilla gorilla beringei)*.

No description of the Virunga ecosystem can be complete without reference to the human-modified environment surrounding the remnant natural forest. A combination of abundant rainfall, good soils and reduced disease risk has made the high elevation lands around the reserve an attractive area for settlement and cultivation for centuries. As the forest has given way to fields of beans, bananas, sorghum and maize, Rwanda's population has increased to over 6 million and settled its 25,000 sq km (9,653 sq mi) of land at the highest densities known in Africa.

Today, the rich lava plains around the PNV contain more than 600 people per square kilometer. It is impossible to understand conservation trends and current prospects for the Virunga reserve without reference to the needs and interests of this large and growing population.

Conservation Trends

The Virunga ecosystem was fully protected as Africa's first national park in 1925. In addition to preserving an area of great scenic and scientific value, a primary goal of the park's supporters was "to make the world safe for mountain gorillas." In 1958, however, Belgian colonial authorities removed 7,000 ha (17,297 acres) of forest from the Rwandan sector for clearing and settlement by local farmers. Ten years later the post-independence government of Rwanda accepted European Development Fund assistance to deforest another 10,000 ha (24,710 ac) for subsistence and cash crop production. Meanwhile, unofficial encroachment was spreading in Uganda and uncontrolled poaching was rampant in the Zairian sector of the range. The net result of these activities was a reduction in the total conservation area by one-third, and a drastic drop in the gorilla population from nearly 500 to no more than 170 individuals.

In recent years conservation prospects in the Rwandan sector of the Virungas have greatly improved. Since 1979, national and international conservation interests have joined in the Mountain Gorilla Project (MGP) to protect the remaining gorillas and their forest habitat in the PNV through a multifaceted approach. Among its successes are an improved park security program which has significantly reduced poaching pressures on the remaining gorillas. Recent censuses indicate a stabilized total population with a growing proportion of infants. In addition, guided hiking tours to view four habituated, yet free ranging, gorilla families in their forest habitat have proved immensely popular with foreign tourists. As a result, income from the PNV has increased over 2,000% since the project's inception, and national tourism receipts now represent a major source of foreign revenue to one of the world's poorest countries. Finally, a major education effort by the MGP and Rwandan authorities appears to be having a positive effect on local attitudes toward a broad range of conservation values.

The accomplishments of the MGP represent a success of major proportions. That the Rwandan government shares in this perception was indicated by their support for the establishment of the park as an International Biosphere Reserve in 1983. Yet much remains to be done. First, continued vigilance is required to assure that poaching does not increase, that tourism does not adversely affect the gorillas or the forest, and that education programs reach all segments of the population. Second, comparable efforts are required in Zaire and Uganda if the overall Virunga ecosystem is to remain a viable functioning unit over the long run. Most important of all, increased attention must be given to the basic needs of surrounding human populations if their demands for food, firewood and farmland are not to conflict with conservation programs.

Development's Role in Conservation

Traditional development was primarily responsible for conversion of more than 40% of the park to croplands in 1968. Economic analyses at that time indicated considerable export potential for pyrethrum as an effective natural insecticide. To satisfy the demand for a non-toxic substitute for DDT and Rwanda's chronic need for foreign revenue, deforestation proceeded without any assessment

Silverback gorilla with female and juvenile. The Virungas were protected as Africa's first national park in 1925 to "make the world safe for mountain gorillas."

of environmental impacts. Alternative sources of income such as tourism were ignored; ecological services such as water catchment and hydrological regulation were discounted. Ironically, pyrethrum production ultimately proved both ecologically and economically inappropriate in the selected region.

Today, environmental assessments required by many development agencies would halt projects similar to the PNV conversion scheme. More importantly, at least some of these agencies are also increasingly supportive of efforts not only to conserve natural areas, but to provide alternatives to their exploitation by needy local populations.

One of the first examples of this approach in Africa is currently underway in the Ruhengeri Prefecture of Rwanda, which includes the Parc National des Volcans. Supported by a grant from the US Agency for International Development, the Ruhengeri Resource Analysis and Management (RRAM) project is designed "to help sustain the regional resource base and to minimize environmental problems associated with development in the Ruhengeri Prefecture." The project is intended to assist the Rwandan government in developing an integrated data base on various renewable resource sectors — including forest, soil, water, wildlife and human — and the relationships among them. Based on this inventory, key environmental trends may be assessed and priority problems identified. From there, a second phase of management interventions is currently planned to deal with selected problems and/or to support research where additional information is deemed essential.

A parallel—and equally important—goal of the RRAM project is to help improve Rwandan institutional capacities to compile, assess and act upon such an integrated inventory on their own. This entails not only the establishment of a mechanism for interministerial communication and cooperation, but also forsees the integration of environmental factors into regional development planning.

The potential benefits of this project to the Volcanoes National Park are many. First, the inventory phase will include a long overdue compilation of existing information on the Virunga ecosystem. In addition, boundary conflicts ranging from human encroachment, woodcutting and poaching to animal damage to surrounding crops will be examined. Preliminary surveys and follow-up meetings with community representatives will assure critically important local input on these issues. To many conservationists, this combination of ecologic and socio-economic information is a prerequisite to development of a long-term park management plan. Information from this resource inventory should also be valuable to development planners. In particular, those responsible for food production and even family planning projects could benefit from increased understanding of the nature and limits of the regional resource base.

Second phase intervention activities of the RRAM project have even greater potential to complement park protection efforts. While these must await results of the inventory and assessment stage, possible activities include sustained yield approaches to bamboo production, agroforestry demonstrations and support for increased conservation efforts. The development of alternative sources of wood and bamboo would directly reduce pressure on these resources within the PNV, while education could increase popular awareness and appreciation of forest conservation values. In addition, the project should help to focus the attention of national and international agencies on other resource management issues.

Finally, it is hoped that the RRAM project will not only demonstrate what development assistance can do to further conservation, but also show what conservation can do for development. Consideration of the Virunga Reserve as an integral part of the overall regional environment, as opposed to its traditional treatment as a separate and unrelated entity, is an essential step in this direction.

From this perspective, the biosphere reserve's economic role in the region is easily quantified on the basis of park-related tourism income and employment figures. Equally important, however, are the various environmental services provided by the Virunga ecosystem. These include *in situ* conservation of rare plant and wildlife species, as well as provision of a research site for comparison of the functioning of a natural forest with that of surrounding agricultural systems. Of particular value is the critical role the montane forest ecosystem plays at all stages of the hydrologic cycle, including rainfall generation, water catchment and regulation of groundwater and streamflow levels. While such services lend themselves less easily to quantification, it is an important part of the RRAM project's task to demonstrate their benefits to those living beyond the boundaries of the park. Without these freely available ecological services, sustainable development in the surrounding area is impossible.

The potential for conservation and development efforts to complement each other is clearly present in and around Rwanda's Parc National des Volcans. This potential was first demonstrated by those conservationists responsible for the multi-faceted Mountain Gorilla Project; the concept was advanced with national and international recognition of the park as a biosphere reserve; its full realization as an integrated use and management strategy for the Virunga ecosystem has moved one step closer with the initiation of RRAM project activities.

While much remains to be done, conservation and development agencies from Rwanda and beyond have provided a model-in-progress for effective cooperation. Specifics of the model are not fully applicable to other areas, due to certain unique attributes of the Virunga region — especially its gorillas, which have served to attract both international attention and tourism revenue. Yet it is hoped that lessons from this effort may be modified and applied to comparable montane areas of East and Central Africa.

Editor's note: If you would like to receive periodic progress reports on the RRAM project, send your request to:

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Caroline Rogers

Toward a Lesser Antillean Biosphere Reserve

Virgin Islands National Park (VINP) on St. John, US Virgin Islands, is among the original group of biosphere reserves designated by UNESCO in 1976. Several characteristics make this area unique among the 41 biosphere reserves in the United States. It is one of the few parks in the national park system which is overtly developing a biosphere reserve program where biosphere reserve status has resulted in substantial research, educational and cooperative activities. It is also the only US national park in a developing region, and the unique opportunities this affords for education and training are being actively explored.

The Virgin Islands Biosphere Reserve (VIBR) encompasses nearly two-thirds of the tropical island of St. John, which has an area of only 20 sq. mi. (52 sq. km.). In general, such small islands are particularly vulnerable to the effects of human activities and development. Unlike larger continental land masses, St. John, with its steep volcanic hillsides, does not have a central terrestrial area far removed from the sea. The coastal "zone" is essentially the entire island, with terrestrial and marine ecosystems closely linked through watershed interactions. Island societies tend to be far more dependent upon coastal and marine resources than are continental areas; consequently, coastal resource planning and management are synonymous with natural resources management on the island as a whole. Like many other Caribbean islands, St. John is economically dependent on tourism which places heavy demands on both human and natural resources.

Accomplishments of the Virgin Islands Biosphere Reserve Program

In May 1983, Virgin Islands National Park was formally dedicated as a biosphere reserve in recognition of its international significance for research and sustainable conservation of the world's ecosystems. The US National Park Service (NPS), which manages the area, declared its renewed commitment to carry out research, management and education programs in the reserve and to coordinate these programs with other institutions in the Lesser Antilles.

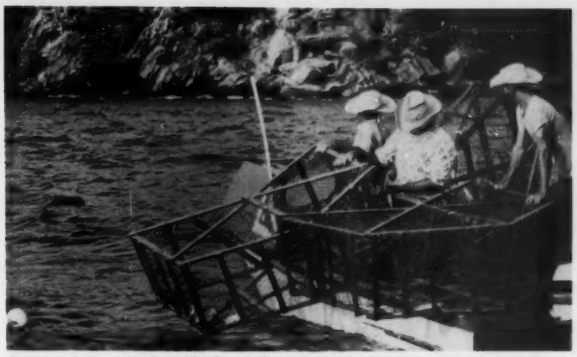
On this occasion, people from several Caribbean islands and international organizations participated in a "Workshop on Biosphere Reserves and Other Protected Areas for Sustainable Development of Small Caribbean Islands." The workshop objectives included: (1) exploring the role of biosphere reserves and other protected areas in sustainable development; (2) assessing the status of information on ecological resources and evaluating the present coverage of protected areas; (3) reviewing the support at the island, regional and international levels for establishing and managing protected areas; (4) identifying initiatives to promote the use of protected areas for enhancing management skills and for supporting conservation and integrated development in the region. An educational videotape based on this meeting has been prepared for use throughout the eastern Caribbean.

Virgin Islands Resource Management Cooperative

Established in 1982 through the initiative of the US National Park Service, the Virgin Islands Resource Management Cooperative (VIRMC) aims to bring together local and regional expertise to solve resource management problems. The Cooperative has 14 members, both private institutions and government agencies, concerned with conservation, research, resource management and economic development in the Virgin Islands region. Support for VIRMC projects has been predominantly from the NPS, although other members and associates have contributed personnel and equipment.

The primary emphasis of the Cooperative has been marine ecological studies; however, research on the relationship of the local residents and their needs to the park and biosphere reserve has also been carried out. VIRMC stresses an interdisciplinary approach; people working on these projects include geologists, historians, managers, foresters, botanists, fisheries biologists, coral reef biologists, anthropologists and social scientists. Recently completed studies include characterization of local fisheries, analysis of the socio-economic and cultural role of fishing, mapping and describing nearshore marine communities, and an inventory of St. John's vegetation. Ongoing projects emphasize long-term monitoring of St. John's coral reefs, fisheries resources and vegetation, and determination of the impact of runoff from the land into coastal marine ecosystems in order to provide the scientific basis for watershed planning and management. The history of land use in critical watershed areas is being compiled to help assess the impacts of historical use and development.

Ongoing watershed studies are focusing on the relationship between land management and the ecology of St. John bays. Hawksnest Bay on the north side of the island illustrates some important marine resource issues. Surrounded by steep hillsides, the bay has a beautiful beach enjoyed by tourists and residents. Construction of a clinic in the upper watershed and the resultant dumping of fill near the head of a gut (intermittent stream bed) may have accelerated erosion and runoff from the hillside during a severe rainstorm two years ago. The resulting increase in siltation may have resulted in the death of nearshore corals. Unfortunately, scientific documentation of these possible effects is lacking to rectify this situation, geologists and biologists are now studying



Research is providing the basis for managing traditional artesanal fishing so as to conserve the marine ecosystems of Virgin Island National Park while improving the economic status of the local people. Photo: US National Park Service.

coral growth rates and establishing permanent study sites to determine if runoff adversely affects these reefs. An historian is providing a land use history of the watershed — important information because clearing of land for sugar and cotton plantations may have correlated with lower coral growth rates documented in the geological record.

As in most VINP bays, the number of charter and private boats is increasing rapidly. Anchor damage and damage from boats running onto the reefs is conspicuous. Endanagered sea turtles. which feed on seagrass beds here, are at risk. In other bays, conflicts between fishermen and boaters are apparent, and efforts are underway to reconcile these conflicts.

VIRMC is striving to carry out the objectives of MAB's Biosphere Reserve Action Plan, of which long-term monitoring is a cornerstone. Compilation of a research history, a comprehensive bibliography and an information synthesis are proposed for 1986.

Principal investigators on coral reef and fisheries monitoring projects have been training students from the College of the Virgin Islands in field techniques and conducting educational sessions on analysis and interpretation of ecological data. Other local residents are participating in establishing long-term study plots in the forests of St. John. Many residents recently participated in four plant identification workshops presented by the College and sponsored by VIRMC.

VIRMC is also working to develop concepts and goals for managing the reserve which take into account the interests, perceptions and needs of involved constituencies. Two workshops held with park employees to present the biosphere reserve concept have led to lively discussions concerning the existing local attitudes toward the park, and conflicts among the different groups of people who use the natural resources. In a recent study of local perceptions, the principal investigator held extensive discussions with fishermen, charter boat operators and dive/snorkel operators to identify marine resource issues and conflicts in marine resource uses. He helped to organize a meeting between the local fishermen and the Park Superintendent which resulted in general agreement that there is overuse of St. John's waters, and some good discussions about park regulations, the condition of park resources and the potential of the biosphere reserve concept.

Educational Outreach Programs

Although the park's interpretive staff discuss the biosphere reserve concept in their presentations, increased emphasis is planned. The park's environmental education coordinator provides environmental programs to local elementary and high schools, leads field trips and organizes teacher workshops. These activities offer opportunities for presenting the biosphere reserve concept to a large number of people.

Although communicating the mission of biosphere reserves is a challenging task, a number of tangible aspects of the concept are likely to generate enthusiasm: (1) people who have seen how surrounding areas have deteriorated over the years can easily appreciate the importance of maintaining an undisturbed site for comparison, and of developing cooperative research and demonstration programs to promote rehabilitation and sustainable development, and (2) the biosphere reserve's emphasis on local participation can foster appreciation of the stake the community has in the success of its programs.

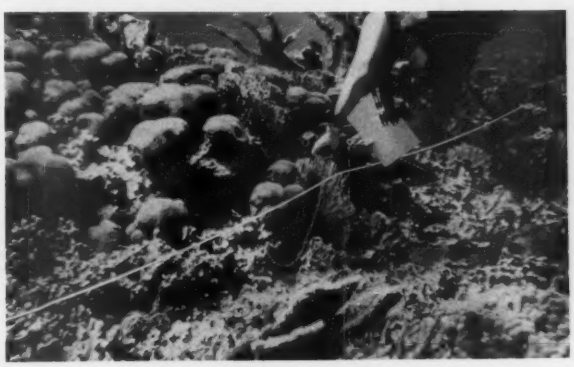
These continuing educational activities within the VIBR are supplemented by articles in local newspapers, updates on VIBR activities for local news broadcasts, talks on resource management issues for college and high school students (given by VIBR staff at the nearby College of the Virgin Islands), and presentations tailored to the needs of special interest groups.

Virgin Island Biosphere Reserve Resource Management Station

A new resource management station is being constructed on St. John expressly for the biosphere reserve. Its four buildings will provide a base of operations for research and resource management activities in the reserve, and a center for regional collaboration on shared problems. The station will include housing for visiting scientists and volunteers, a small laboratory and library, a storage area for collections, and facilities for small conferences, workshops and seminars. When completed, hopefully by the end of 1985, the station will provide a symbolic foothold for the biosphere reserve program in the Lesser Antilles. It will be a focal point for developing practical programs to meet the common needs of VIBR and the region. Finally, it will also be a center for programs to involve local people in building the biosphere reserve.

Expansion of the Virgin Islands Biosphere Reserve—A Possible Next Step

Ideally, a biosphere reserve should fully represent the ecological communities of the biogeographic province within which it is lo-



Permanent research plots are being established in the Virgin Islands Biosphere Reserve to assess the impacts of anchorage, recreational diving, and siltation from land-based development on coral reefs. Photo: US National Park Service.

cated. While VIBR appears to be representative of many of the ecosystems of the province, particularly nearshore marine communities, it would benefit from the inclusion of additional areas on St. John and in the nearby British Virgin Islands. For example, extensive mangrove communities bordering Coral Bay, St. John, outside the park are likely to be important nursery areas for lobsters and fish in the park. The possible inclusion of the ecologically complementary lands and waters of the British Virgin Islands, which adjoin St. John, could help foster cooperation on a wide range of resource management issues, including protection of endangered species and fisheries. The recent inclusion of BVI National Parks Trust on Tortola as a VIRMC member is a positive step toward this cooperation.

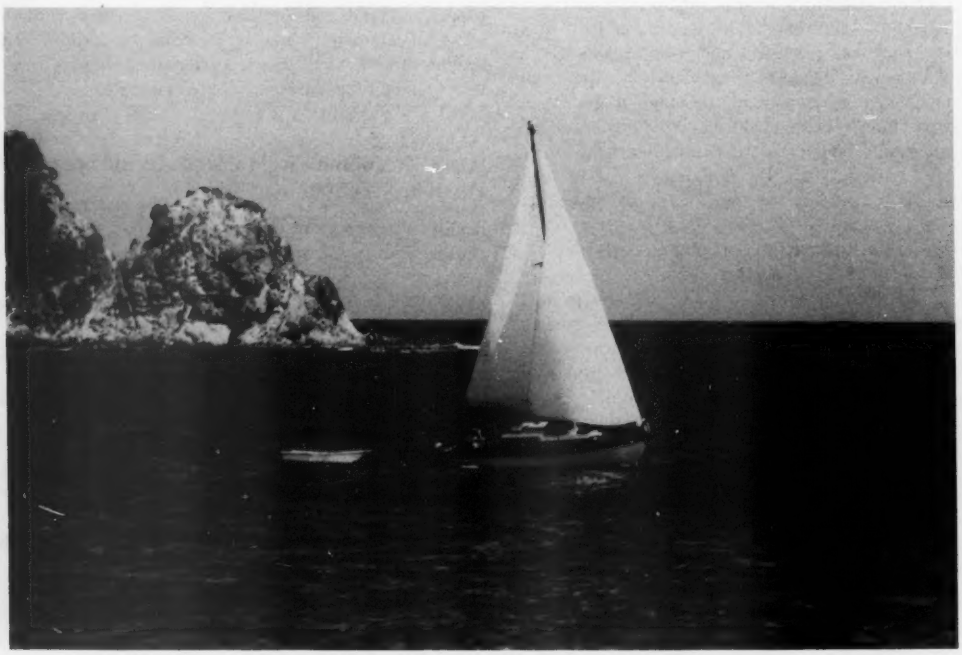
A Lesser Antillean Biosphere Reserve?

The concept of a multi-site biosphere reserve, based on the realization that one site cannot accommodate all biosphere reserve functions, is still evolving. Recent studies have identified outstanding examples of marine and terrestrial ecosystems in the Lesser Antilles. As a first step in building a multi-island biosphere reserve, a cooperative relationship could be established between the existing VIBR and protected areas on other islands, which could include examples of the tropical rainforest, cloud forests and other communities not currently represented in the VIBR. Such cooperative working relationships would provide the means for demonstrating the practical benefits of the biosphere reserve approach. Eventually it may be possible to establish a Lesser Antillean Biosphere Reserve as a framework for regional and international cooperation in research and in marshalling technical and financial resources to help solve common resource management problems.

Sites under consideration for inclusion in a Lesser Antillean Biosphere Reserve should be representative of natural and institutional systems; offer possibilities for sharing personnel and educational research and training facilities, encompass multiple zones, including one or more highly protected core areas, traditional use areas, experimental areas and rehabilitation areas; and have the potential for involving local communities in research and educational programs. Particularly promising areas include Anegada and surrounding waters of the British Virgin Islands representing the largest reef complex in the Lesser Antilles, as well as Morne Trois Pitons National Park in Dominica, and Mount Pelee on Martinique, excellent examples of mountain ecosystems.

The Virgin Islands National Park is enthusiastic about meeting the challenge of implementing the biosphere reserve concept. The number and breadth of the ongoing activities attest to a strong commitment to build a model biosphere reserve which assures the security of an outstanding national park, contributes to solving the interrelated ecological and socio-economic problems of the region, and fosters the well-being of the local people, whose involvement and support will be key ingredients in success.

Dr. Rogers is research biologist at the Virgin Islands National Park and Executive Officer of the Virgin Islands Resource Management Cooperative.



R. Michael Wright, Brian Houseal and Cebaldo De Leon

Kuna Yala: Indigenous Biosphere Reserve in the Making?

When a Kuna Indian awakens on one of the small coral islands off the Panamanian coast where most of his people live, his gaze wanders past the thatched houses of his neighbors, out over the low-riding canoes of farmers heading for their mainland plots, and then across a mile or so of shimmering water to a mass of green rest rising, virgin and luxuriant, to the ridge of the San Blas mountains. At his back, the sun climbs above the calm Caribbean, and its first rays strike the tufts of mists snagged like fleece in the clefts of the hills. For generations, this dawn panorama, serene and unchanging, has greeted the Kuna People.

But if he were standing atop the 2,400 foot high San Blas Range, the view down the other slope would be less reassuring. Large swaths of thick vegetation have fallen victim to the machete and the torch. Ash-grey tree trunks stand above the denuded landscape, skeletal remnants of the once towering jungle.

Patrick Breslin & Mac Chapin

Teenage Kuna girls dressed in colorful native attire. Photo: Mac Chapin.

During the last decade concern for disappearing tropical forests has grown increasingly acute for the conservationists and protected area managers of the world. The earth's tropical forests, both representative and exceptional, are being cut at an alarming rate. Deforestation in Panama is currently 50,000 ha (123,550 ac) per year and the wet tropical forest of the Kuna reservation, with its astonishing diversity of plant and animal life, is one of only a half dozen large tracts of original forest left in all of Central America.

A convergence of interests — the conservationists' concern for threatened biological and natural resources and the determination of the Kuna Indians to resist a threat to their cultural survival—may result in a unique biosphere reserve. The IUCN report *The Biosphere Reserve and its Relationship to other Protected Areas* states "To be successful [a biospheres reserve] must preserve areas of undisturbed nature as genetic reservoirs and as standards against which change outside can be measured and judged. It must equally include man and his works. If handled imaginatively it should provide an excellent opportunity of increasing understanding of the problems of the biosphere and involving people, especially local people, in conservation and research having a vital bearing on their own future." In the Pemasky (Proyecto de Estudio para el Manejo de Areas Silvestres de Kuna Yala) project the Kuna are beyond participation, they are in charge. The biosphere reserve, if it is so designated, will be established, managed and integrated into the local society by the Kuna themselves.

The Comarca de Kuna Yala (reservation of the Kuna Indian established in 1938) is an isolated stretch of lush tropical jungle 124 miles (200 km) long and averaging 16 miles (26.7 km) wide, extending from the Continental Divide to the coast on the Caribbean side of Panama. Thirty thousand Kuna Indians reside in 60 villages on some of the 350 tiny, offshore coral islands, their tightly packed thatched houses seeming to float inches above the bright Caribbean sea, supporting themselves with fishing and complex multi-crop agriculture on the flat alluvial soils of the coast.

Traditionally the forested mountain divide has proven to be a valuable buffer to protect the reservation from the ravages of the slash and burn and cattle economies of Panama's interior. As the abode of spirits and a source of medicinal plants, the maintenance of tracts of primary forest serves essential cultural needs. Less well recognized, even on the islands themselves, is the ecological link between the forest hydrological system and rivers which provide the Kuna access into the interior; erosion from deforestation of these mountains, with their 2,500-3,500 mm (100-140 in) of rain per year, could also jeopardize the coral reefs and marine system which provide the Kuna their primary source of protein.

Yet the forest which prevents encroachment means the Kuna themselves can only leave the reservation by boat or plane, and with increasing fuel costs these expenses are becoming prohibitive. Thus the Kuna were intrigued by the proposal of US/AID in the early 1970s to put a road into the western end of the reservation from El Lano on the Pan-American Highway to the tiny airstrip at Carti. However, as construction proceeded apace concern mounted among some Kuna who recognized that, unless a perma-

Many Kuna women, such as this young mother, wear colorful embroidered blouses called "molas." Photo: Mac Chapin.

nent presence could be established where the road penetrated the reserve, squatters would quickly flow into the reservation. In 1975 an enthusiastic and committed group of young Kuna began to establish an agriculture community at the vulnerable point, but the attempt failed when coastal techniques proved inappropriate to the ecological zones of the mountains and the Kuna elders, with their traditional knowledge, were not effectively brought into the effort. After a frustrating five years, the young Kuna decided to join tourism, scientific research and a protected area (modeled on traditional Kuna spirit reserves) in order to enlist the support of the outside conservation and scientific community in their cultural preservation goals. Advice was sought from CATIE (Centro Agonómico Tropical de Investigación y Ensénanza) in Costa Rica and the Smithsonian Tropical Research Institute in Panama with the bulk of the financial resources provided by the Interamerica Foundation as well as World Wildlife Fund-U.S. and the Kuna themselves.

The conservation success of the project depends, as does its ecological aspects, on the link between the mountains and the coast, the young defenders of the reservation and the traditional knowledge base of the islands, the balance of scientific tourism and the cattle culture of the interior. The project has now received the blessing of the Kuna General Congress and every other week volunteers from the island communities come to Pemasky to help demarcate the border of the reservation, returning with an awareness of the devastated landscape beyond the mountains. The Pemasky — or Kuna Wildlands — Project also provides a link between the populations of Kuna at both ends of the reservation and is seen as a model for resource management and defense of the Comarca as a whole. The goals of the protected area complex have now grown beyond merely holding the line along the border of the 60,000 ha (148,260 ac) study area in the western sector of the reserve to the possibility of including the entire Comarca and perhaps some adjacent protected areas in subsequent phases of the project. As a result, the Kuna have begun to seek a classification appropriate to the mixed objectives of their initiative. The protected area designation should not threaten the Kuna culture by injecting national institutions into the Comarca, but, instead, should recognize the unique legal protection provided by the Kuna's land title (by law non-Kuna are prohibited from holding land in the reservation).

For the moment the biosphere reserve is the only category of protected area that seems appropriate to this project. Interestingly enough, the concept of the biosphere reserve, which seeks to conserve representative samples of the world's biogeographical regions and man's traditional relationships to them, coincides directly with the Kuna Indian concept of "Kuna Yala" (Kuna place, or territory) being an integral part of "Abia Yala" (the mother earth, biosphere) and thereby worthy of conservation for cultural and spiritual reasons.

Scientific research and tourism, as well as a core protected area, would be included in the Pemasky complex in the mountains of Nusagandi. Terrestrial and marine systems important to Kuna life ways will be maintained. Their traditional multi-crop agricultural system will continue on the coastal fringe (a recent study edited by Moreno and McKay of one small area identified 72 agroforestry combinations, utilizing 48 species of trees and 16 crop plants), and the islands will retain their status as centers of the Kuna culture. Ironically, the one management area missing within the reservation is a rehabilitation or restoration area, and the objective of the project is to keep it so. However, already serious degradation is taking place on the portion of the Panamanian side of the Continental Divide which could be incorporated into a biosphere reserve. Ideally such an area under Kuna control could provide an additional buffer and a legal basis for Kuna management beyond the reservation proper.

The biosphere reserve designation needs exploration at both the international and national level but, like every aspect of this project, the ultimate decision will rest firmly with the Kuna themselves as perhaps the most socially and culturally cohesive indigeous society in the hemisphere. The Pemasky project demonstrates the potential of the biosphere reserve concept to provide an international linkage between projects whose uniqueness would otherwise have to be compromised if not destroyed to make them fit into more traditional protected area classification systems.

Looking out across Kuna dug-out canoes from the San Blas Islands toward the mist shrouded mainland of Panama. Photo: Michael Wright.

Bibliography

Patrick Breslin and Mac Chapin "Conservation Kuna-Style" 8:2 Grassroots Development: *Journal of the Inter-American Foundation* (1984)

Catherine Caufield, *In the Rainforest,* Alfred Knopf (1985); Adrian Forsyth and Kenneth Miyata, *Tropical Nature,* Charles Scribner & Sons (1984)

Norman Myers, *The Primary Source: Tropical Forests and Our Future* W. W. Norton (1984)

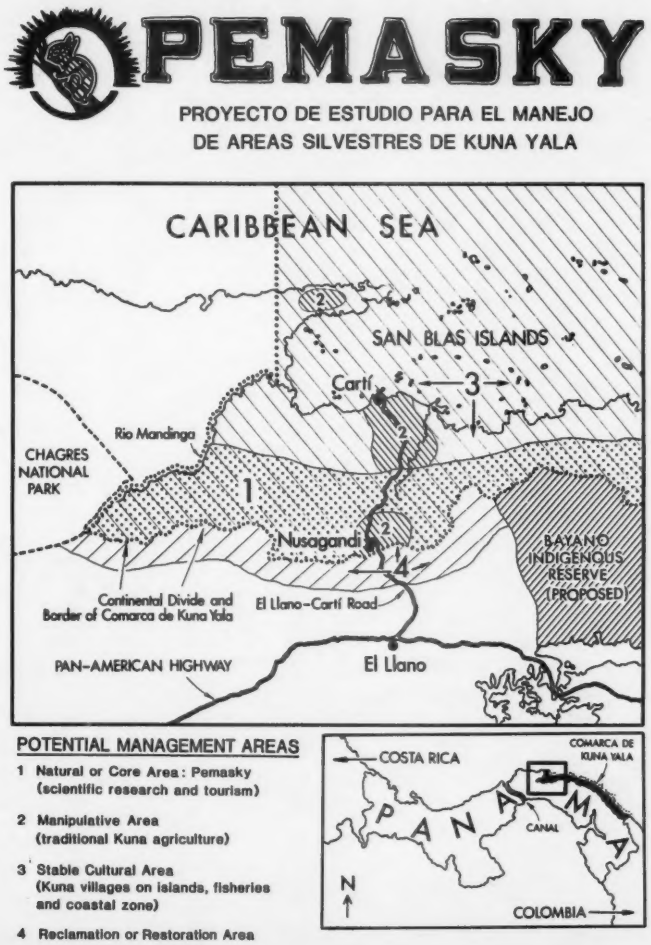
Brian Houseal, Craig MacFarland, Guillermo Archibold and Aurelio Chiari, "Indigenous Cultures and Protected Areas in Central America" 9:1 *Cultural Survival Quarterly* (Parks and People), (Feb 1985)

CNPPA, *The Biosphere Reserve and its Relationship to other Protected Areas* IUCN, (1979)

Stanley Heckadon Moreno and Alberto McKay (eds) *Colonizacion y Destruccion de Basques en Panama,* Panamanian Anthropology Asso. 1982

Typical Kuna village scene. Photo: Mac Chapin.

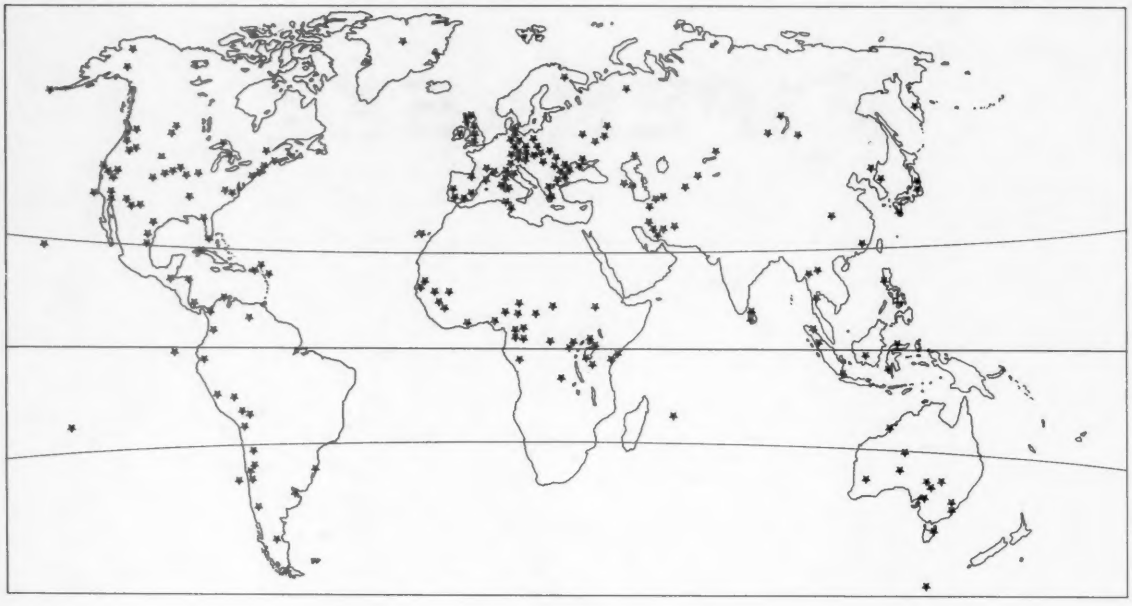
R. Michael Wright, project officer for the Kuna project, is vice president of the World Wildlife Fund-US, Washington, DC. Brian Houseal, technical consultant for the Kuna project, is with CATIE, Turrialba, Costa Rica. Cebaldo De Leon is a Kuna anthropologist assisting with drafting the management plan for the Kuna Pemasky project, Comarca de Kuna Yala, Panama.



Biosphere Reserves Around the World

There are 243 biosphere reserves world-wide. The following list indicates the number designated in each country:

Argentina—3
Australia—12
Austria—4
Bolivia—2
Bulgaria—17
Byelorrusian SSR—1
Cameroon—2
Canada—2
Central African Republic—2
Chile—7
China—3
Colombia—3
Congo—1
Costa Rica—1
Cuba—1
Czechoslovakia—3
Denmark (Greenland)—1
Ecuador—1
Egypt—1
France—4
Gabon—1
German Dem. Rep.—2
Germany, Fed. Rep. of—1
Ghana—1
Greece—2
Guinea—2
Honduras—1
Hungary—5
Indonesia—6
Iran—9
Ireland—2
Italy—3
Ivory Coast—2
Japan—4
Kenya—4
Korea, Rep. of—1
Mali—1
Mauritius—1
Mexico—3
Nigeria—1
Norway—1
Pakistan—1
Panama—1
Peru—3
Philippines—1
Poland—4
Portugal—1
Romania—3
Rwanda—1
Senegal—3
Spain—9
Sri Lanka—2
Sudan—2
Switzerland—1
Tanzania—2
Thailand—3
Tunisia—4
Uganda—1
Ukranian SSR—2
USSR—14
United Kingdom—13
United States—41
Uruguay—1
Yugoslavia—2
Zaire—3



PARK TECHNIQUES

Low Cost Aerial Photography

Roger de La Harpe

The Natal Parks Board, responsible for conservation and recreation throughout the Province of Natal in South Africa, has 52 game reserves and resorts under its wing.

Aerial photographs, for planning and management p rposes, were required by the Recreation Division. Commercial institutions were available to do the work for u- but costs were prohibitive, and in any case we had the necessary equipment — an aeroplane (Cessna 182) and a camera (Hasselblad 500 EL/M). All that was required was some way of combining the two.

The method used had to fall within four basic parameters:

(1) There were no funds available so no materials could be purchased or any work subcontracted;
(2) no modifications, such as cutting holes in the floor or removing seats, could be made to the aircraft as this would be costly and would make it less suitable for transporting people;
(3) the camera had to be fitted to a removable bracket as flying times to the target areas are relatively long and any protuberances would affect the aircraft's performance; and
(4) it should be possible to take photographs with a full complement of passengers aboard to avoid the need for special trips.

A method which satisfied all these requirements was to attach a bracket to the door frame which could be fitted and removed during flight. It would also enable a certain amount of levelling but no drift corrections, which was acceptable. The Cessna 182 is a high wing aircraft which facilitates this sort of attachment, however, with the wing in any other position, some other arrangement should be sought.

Construction

The frame was made from 12mm square steel bar, and 1.5mm sheet was used for the clamp faces which were lined with a soft plastic to protect the paintwork on the aircraft door. This material was used simply because of its availability and any similar materials would be equally effective.

Photograph 1 shows the camera mounted in the bracket. The distance from the side of the door to the centre line of the lens should be found by experimentation, the idea being to exclude any part of the aircraft from the picture.

In photograph 2 the camera and mount can be seen fitted to the door. To facilitate manoeuvering the camera and mount, the small stay which holds the window open had to be removed. The airflow past the window would normally hold it fully open but, as we have fitted an air deflector just behind the windscreen (see photograph 2) to reduce airblast in the cabin, the window tends to flap. To prevent this a magnet was fitted to the lower edge of the frame and a strip of ferrous metal to the wing. The window can then be pushed to the fully open position and the magnet will hold it there.

Scale Calculations

Scale on the film can be calculated using the formula:

$1/S = F/H$

Where S = Scale
F = Focal length of the lens in ft.**
H = Flying height above the ground in ft.

**The Focal length of the standard 80mm lens is 0,2625 ft.

Uses For Aerial Photographs

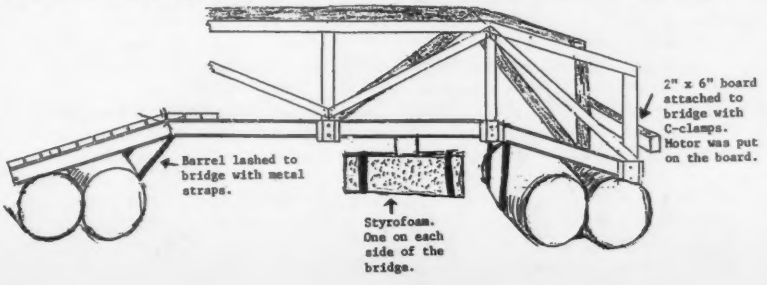
The photographs are used in a number of different ways: (a) as a basic print for development concept planning and for orienting people unaccustomed to the area—ideally suited to committee work; (b) as a base for maps, either by tracing directly off the photograph or by enlarging the negative onto drawing film. The sepia can now be used as a background to maps or as a method of producing low cost prints albeit at a slightly lower quality; (c) for monitoring changes in areas, such as vegetation and erosion.

The photographs have proved to be extremely useful and requests for them are becoming more frequent.

R. de La Harpe is with the Natal Parks Board. Pilot Ginger Skinner assisted in the development of this system.

Replacement Footbridge Moved By Water

Fort Donelson National Military Park in Tennessee was established in 1928 to protect the remains of a Civil War fort, its water batteries and breastworks. Two years ago a footbridge along a seven mile circular trail collapsed, leaving a narrow steel girder as the only means of crossing the 5.8 meter wide and 2 meter deep Indian Creek waterway. Construction on the site was im-


2" x 6" board attached to bridge with C-clamps. Motor was put on the board.
Barrel lashed to bridge with metal straps.
Styrofoam. One on each side of the bridge.

possible without causing serious damage to a steep embankment and thickly wooded swampy area surrounding the stream. Maintenance Forman J. T. Jackson was faced with a challenge.

A prefabricated bridge was put together in the park maintenance area, then floated upstream to the site. To accomplish this, two 55-gallon barrels were lashed to each end of the bridge with 1-inch metal straps. Stabilizers consisting of two pieces of styrofoam (30x37x120 cm) were attached to both ends of a 5x15 cm plank attached to the bottom of the center of the bridge so the plank ends extended equal distances on both sides. Another plank attached to the back of the bridge by C-clamps provided support for a 96-cc outboard motor.

The entire "boat" was lowered into the water with a front-end loader. Under power of the outboard motor, the craft eased its way around the hollows that bordered the park for about 2 kilometers.

At the site, the structures had to be turned crossways (90°) in the creek by means of hand winches and ropes. Once in place, the bridge was further stabilized by anchor bolts attached to previously poured pillars of concrete located on both sides of the stream.

Visitors once more can walk the entire trail without risking a dunking, thanks to an innovative park staff.

This material and the sketch were submitted by Superintendent John W. Stockert and his maintenance staff.

Dowel Plugs For Signs

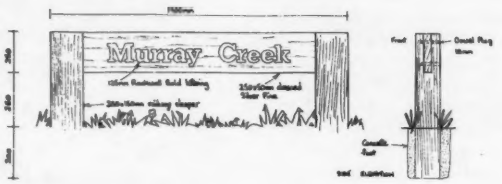
Dave Adams, recreation planner for the New Zealand Forest Service, forwarded the following helpful tip for fastening signs for easy removal.

A traditional means of attaching sign boards to their morticed posts is with galvanized coach screws or bolts. However, these are time consuming, awkward to assemble, costly and unsightly.

Les Nichols, carpenter at Victoria Forest Park on the West Coast of New Zealand's South Island, has come up with a practical alternative. Dowel plugs, inserted into pre-drilled holes and then glued, enable fast construction of signs, are inexpensive, and produce a clean, tidy finish.

When dowelled from the back, the board can be secured to the post without any sign of attachment visible from the front.

Dowel plugs have advantages for sign maintenance. If a board requires repair or replacement, it is a simple task to drill out the dowels and lift the board out of the mortice. The only tool necessary is a hand brace and bit. The post can be left concreted in place, ready for a new board.



IUCN commission on National Parks and Protected Areas

CNPPA NOTES

International Wildlife Film Festival

The University of Montana Student Chapter of the Wildlife Society is sponsoring the ninth Wildlife Film Festival April 7-13, 1986.

The festival will include a wildlife program, a wildlife writers' conference, and a symposium on the interrelationships and influences between wildlife or wildlife sciences and the humanities.

Deadline for film submission is March 17, 1986. All entries must have a predominantly wildlife theme and have been produced or released during calendar year 1985. Categories include amateur, professional, commercial, scientific, TV series, and experimental.

Information, rules and entry forms are available from:

Wildlife Film Festival
Wildlife Biology Program
University of Montana
Missoula, Montana 59812, USA

International Symposium on Mountain Vegetation

The first announcement and call for papers for the International Symposium on Mountain Vegetation has been issued by the Chinese Association for Science and Technology and the Committee on Plant Ecology and Geobotany of the Botanical Society, China, cosponsors. The meeting will be held September 1-5, 1986, in Beijing, China.

Topics include the characteristics of vegetation in mountainous areas and their vertical distribution, the structure and function of mountain vegetation as a component of mountain ecosystems, and the management, rational utilization and protection of mountain vegetation.

The registration fee of US$180 includes proceedings, transportation to conference activities, welcoming reception, cultural performance shows and the banquet. Further information is available from:

Mr. Chen Weilie
Institute of Botany, Academia Sinica
Beijing, China

Resource Network for Latin America and the Caribbean

The Coolidge Center for Environmental Leadership is developing a resource center and directory on environmental and development agencies operating in the Latin American and Caribbean regions. A directory of Latin American and Caribbean institutions will be printed in the near future.

The center will maintain a library and active files on (1) governmental and non-governmental agencies concerned with sustainable development and the environment, (2) graduate professional schools and intern opportunities, (3) publications, books, periodicals and research papers, and (4) conferences and seminars.

The project is seeking information and assistance in the following areas: (1) listings of environmental and development agencies in Latin America and the Caribbean, (2) newsletters and periodicals pertaining to international environmental and development issues, and (3) listings of appropriate publications and research papers. Further information is available from:

The Coolidge Center
1675 Massachusetts Ave.,
Cambridge, MA 02138, USA

BOOKS AND NOTICES

Culture and Conservation: The Human Dimension in Environmental Planning. 1985. Jeffrey A. McNeely and David Pitt, eds. International Union for Conservation of Nature and Natural Resources (IUCN) Gland, Switzerland. Croom Helm, Dover, New Hampshire. pp. 308. Price US$31.00.

This is an important book. Addressing conservationists, resource managers, environmental planners, anthropologists and other social scientists, it proposes alternative approaches to achieving conservation with ecologically-sustainable development.

The usual approach, in contrast to the one proposed, finds university-trained specialists acting as custodians of the natural environment and the practices required for its protection. This often leads to management strategies that profoundly affect native communities, yet disregard their land tenure practices, environmental understandings, and other cultural aspects. Seldom do technical experts invite traditional peoples to help formulate conservation projects, although the native's unique "grass-roots" insights, honed by decades of experience with local habitats, should form their design, application, and evaluation. Ignoring these insights is likely to bring inappropriate projects with few benefits and high risks to the habitat and the delicate balance that marks traditional resource use.

Editors McNeely and Pitt reject "top-down" planning in favor of the perspective they call "conservation from below." Pivotal is the view that people whose cultures traditionally have depended on waterways, arable land or other natural resources usually evolve ecologically sound practices to conserve vital subsistance resources. This culture of convervation reflects intimate and systematic understandings of the local environment. These are unlikely to be written or readily verbalized, but must be deduced from systematic observations or interviews. Regardless of the discovery technique, worldwide conservation goals will suffer measurably, the editors warn, unless managers, planners and environmentalists tap local cultures for their rich "reservoirs of traditional conservation knowledge and experience."

McNeely and Pitt have compiled 21 case studies prepared by culturally-minded environmentalists and ecologically-oriented cultural anthropologists and other social scientists for the IUCN's 1982 meeting at Switzerland or the subsequent Bali conference. Additional materials come from international public and private agencies. Following their introduction, the editors group the papers into five principal themes, each introduced by brief comments: rethinking concepts for conservation and indigenous people; management for and with people; traditional and indigenous knowledge and practice; conservation and environmental planning by the people; and where are we going.

The materials are informative and stimulating as well as international, covering Africa, South America, India, Canada, Spain, the Pacific and elsewhere. For example, Vayda, Pierce Colfer and Brotokusumo document the interactions between Borneo's tropical forest peoples and local ecosystems. They show native peoples as rational decision-makers whose intimate knowledge of the local terrain enables them to evaluate alternative land uses, including projects that outsiders suggest. Practical environmental knowledge and willingness to modify customary actions when benefits outweigh the costs make local peoples valuable partners in the conservation movement. The Borneo materials also raise questions about the value of programs in conservation education when it is survival needs, not educational deficiencies, that drive a peoples' resource use. Jacobs discusses environmental planning in Canada's Northwest and proposes measures to increase effective Inuit and Indian participation in the process. These include utilizing the native environmental knowledge base and perspectives on time, space and technology, and incorporating native peoples in planning and management.

Drawing upon Latin American situations, Brownrigg proposes conservation options that both native peoples and national resource managers might find acceptable: (1) native-owned lands, where native holdings are designated protected areas and natives made responsible for their protection, (2) reserves, where national agencies and native communities jointly administer protected areas, (3) buffer zones, where national agencies administer an area separating native from non-native holdings, (4) research stations, where native peoples instruct outside specialists on the ecology of their traditional use areas. Clad discusses collaborative possibilities between conservationists and indigenous peoples based on New Zealand experiences such as the Maori's gifting of land to the nation and the development of multiple use areas that permit indigenous harvesting.

Nowicki suggests that the lingering concept of the "noble savage," who requires outside guidance to use local resources effectively, still blinds the non-noble from seeing that the best management strategies might be those traditional peoples have already evolved for themselves. He exhorts outsiders to learn native management principles in order to appreciate the very ecosystems they wish to protect. I would caution, though, that regard for traditional cultures not lead to romanticizing traditional peoples as "noble conservationists." Overpopulation, land loss to commercial interest groups, and other factors are shrinking the native resource base. Without reasonable subsistence options, native peoples often either adopt inappropriate Western technologies or continue to use traditional ones despite their potential destructiveness in a constrained environment.

A book of this scope and size inevitably has some unevenness. Although most papers are grounded in sound data, a few suffer from inadequate empirical materials. Brief biographies about the authors would have been useful to help readers evaluate their papers. These minor points aside, as a cultural anthropologist concerned with the interface of culture and environment, I found this book informative and provocative. Promising too is the dialogue between naturalists with expertise in local ecosystems and social scientists with expertise in the cultural adaptions of native peoples. Park managers and planners who subscribe to the IUCN mandate that conservation concerns must be wedded to local cultures will concur with this book's fundamental message and profit from its supporting case studies. Those less familiar with the perspective will find it a useful introduction.

— Muriel Crespi
Anthropology Division, U.S. National Park Service

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The griffon vulture (Gyps fulvus) *is one of the species that is being reintroduced into Cevennes National Park in southern France. He can be distinguished from other vultures by very long, broad wings with widely spread primaries forming rounded ends, and a very short, dark, squared tail. The prominent ruff is whitish in adults and brown in juveniles. Photo: UNESCO*

Back cover: Snow-capped peaks dominate the town of Waterton Lakes in the Waterton-Glacier International Peace Park straddling the Canada-United States boundary. The distant 40% of Upper Waterton Lake is located in Glacier National Park in the US, while the remainder of the water body lies in Waterton National Park. Photo: S. Lunn, Parks Canada

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